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Muon dE/dx and Range Tables for Tevatron Energies:

Results for Some Shielding Materials

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In designing an upgraded muon shield, the existing calculations for the muon energy loss rate (dE/dx) and range had to be extended to those energies expected from the Tevatron. Previous technical memos (TM-229¹ and TM-260²) provided results for energies up to 500 GeV. TM-229 gave results which considered contributions from collisions, i.e., atomic ionizations & excitations, pair productions, bremsstrahlungs & nuclear interactions. TM-260 provided muon ranges based only on the collision process since the other three processes, being subject to large fluctuations, could result in seriously underestimated maximum ranges. In this TM, results will be given for calculations for muons that will be produced by the Tevatron considering various types of loss processes.

The tables and graphs were generated using a slightly modified version of the FORTRAN program NALMURG. The energy loss rate for the collision losses has been corrected for the density effect³ in the various materials considered. The muon range is obtained by the numerical integration of the energy loss from a threshold energy of 10 MeV to the energy of interest plus the range of muon at the threshold energy. Multiple Coulomb scattering and straggling effects⁴ were neglected in these calculations.

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Results are provided for iron, "moist" Fermilab soil, lead and uranium. The calculation for soil is based upon the analysis of the soil given in TM-168⁵. A nominal soil density of 2.0 gm/cm³ was assumed and only those elements which contributed 1% or more of the total weight of the soil were considered in the calculations. A reasonable range of values for soil is from 1.7 to 2.1 gm/cm³. "Moist" soil assumes a water content of 10%, although the water content of the Fermilab soil may be as high as 14%.

Tables 1a-d provide the results for iron considering atomic collisions only. Tables 2a-d provide the results for soil using atomic collisions only. Tables 3a-d and 4a-d provide values for lead and uranium respectively using atomic collisions as the only loss process.

Tables 5a-d, 6a-d, 7a-d and 8a-d provide values for iron, soil, lead and uranium respectively using atomic collisions and pair productions as the energy loss processes.

Tables 9a-d, 10a-d, 11a-d and 12a-d give values for iron, soil, lead and uranium respectively using as the loss processes atomic collisions, pair productions and bremsstrahlungs.

Results for calculations including atomic collisions, pair productions, bremsstrahlungs and nuclear interactions are provided by Tables 13a-d, 14-a-d, 15a-d, and 16a-d respectively for iron, soil, lead and uranium.

The format for these tables are as follows. The top two lines identify the substance and the energy loss process(es)

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employed in calculating the dE/dx and range tables. The third line gives the fraction (by weight) of the element(s) considered for this calculation. The fourth line provides the inverse of the radiation length. The fifth line is the label for the columns of the data. The first column from the left provides the muon energy in GeV, the second column the associated momentum in GeV/c , and the third column gives the rate of "total" energy loss (dE/dx) in units of $\text{MeV}/\text{gm}/\text{cm}^2$. The range of the muon of the given energy is provided in columns four, five and six using units of gm/cm^2 , centimeters, and feet respectively. The seventh, eighth, ninth and tenth columns respectively give the partial dE/dx in units of $\text{MeV}/\text{gm}/\text{cm}^2$ for atomic collisions, pair productions, bremsstrahlungs and nuclear interactions. Note that partial dE/dx due to process(es) not considered in arriving at the "total" dE/dx are still printed in the tables. They have been printed to indicate what their contributions would have been without having to go to a different table. However, the "total" dE/dx column adds together only the partial dE/dx from the process(es) mentioned in the heading of the tables.

The dE/dx data from the tables have been plotted for soil, iron, lead and uranium for various energy loss process(es). The associated data for range has also been plotted except for the lead data. The points for lead and uranium are very close to each other so that the lead data points have been suppressed from the range plots.

Figures 1 & 2 respectively, provide plots for dE/dx and range considering only atomic collisions.

Figures 3 & 4 respectively, give dE/dx and range plots for data considering atomic collisions and pair productions.

Figures 5 & 6, give plots respectively for dE/dx and range considering atomic collisions, pair productions and bremsstrahlung processes.

Figures 7 & 8 are the plots for dE/dx and range respectively for processes considering atomic collisions, pair productions, bremsstrahlungs and nuclear interactions.

The computer program used was a slightly modified version of the program originally written by R. G. Alsmiller, Jr. and J. Barish of O.R.N.L. and transmitted to me via D. Theriot and A. Van Ginneken of Fermilab. I am particularly indebted to D. Theriot for his help and useful discussions.

References

1. D. Theriot, Muon dE/dx and Range Tables: Preliminary Results for Shielding Materials, Fermilab TM-229 (30 March 1970).
2. D. Theriot, Muon dE/dx and Range Tables: Results for Shielding Materials Using Collision Losses Only, Fermilab TM-260 (21 July 1971).
3. R. M. Sternheimer, Phys. Rev., 88, 851 (1952); 103, 511 (1956); 115, 137 (1959); 124, 2051 (1961); 145, 245 (1966) & 164, 349, (1967).
4. R. M. Sternheimer, Phys. Rev., 117, 485 (1960).
5. M. Awschalom, T. Borak & P. Gollon, Chemical Composition of Some Common Shielding Materials, Fermilab TM-168 (2 May 1969).

Table Ia
IRON
Atomic Collision

Table 11
IRON
Atomic Collisions

F	P	RANGE	DE/DX-TOT (GFV/GM/GMSQ)	DE/DX-PARTIAL (MFV/GM/GMSQ)	COLLISION (GM/GMSQ)	DE/DX-PARTIAL PROD(MFV/GM/GMSQ)	NUCLEAR PROD(MFV/GM/GMSQ)
24.0E+01	25.0E+01	17.4E+01	1.4E+04	1.4E+04	1.4E+01	1.4E+01	1.4E+01
26.0E+01	27.0E+01	17.5E+01	1.58E+04	1.58E+04	1.59E+01	1.59E+01	1.59E+01
28.0E+01	29.0E+01	17.6E+01	1.69E+04	1.69E+04	1.70E+01	1.70E+01	1.70E+01
30.0E+01	31.0E+01	17.7E+01	1.81E+04	1.81E+04	1.75E+01	1.75E+01	1.75E+01
32.0E+01	33.0E+01	17.8E+01	1.92E+04	1.92E+04	1.77E+01	1.77E+01	1.77E+01
34.0E+01	35.0E+01	17.9E+01	2.04E+04	2.04E+04	1.77E+01	1.77E+01	1.77E+01
36.0E+01	37.0E+01	18.0E+01	2.14E+04	2.14E+04	1.78E+01	1.78E+01	1.78E+01
38.0E+01	39.0E+01	18.1E+01	2.25E+04	2.25E+04	1.79E+01	1.79E+01	1.79E+01
40.0E+01	41.0E+01	18.2E+01	2.36E+04	2.36E+04	1.80E+01	1.80E+01	1.80E+01
42.0E+01	43.0E+01	18.3E+01	2.47E+04	2.47E+04	1.81E+01	1.81E+01	1.81E+01
44.0E+01	45.0E+01	18.4E+01	2.58E+04	2.58E+04	1.82E+01	1.82E+01	1.82E+01
46.0E+01	47.0E+01	18.5E+01	2.69E+04	2.69E+04	1.83E+01	1.83E+01	1.83E+01
48.0E+01	49.0E+01	18.6E+01	2.80E+04	2.80E+04	1.84E+01	1.84E+01	1.84E+01
50.0E+01	51.0E+01	18.7E+01	2.91E+04	2.91E+04	1.85E+01	1.85E+01	1.85E+01
52.0E+01	53.0E+01	18.8E+01	3.02E+04	3.02E+04	1.86E+01	1.86E+01	1.86E+01
54.0E+01	55.0E+01	18.9E+01	3.13E+04	3.13E+04	1.87E+01	1.87E+01	1.87E+01
56.0E+01	57.0E+01	19.0E+01	3.24E+04	3.24E+04	1.88E+01	1.88E+01	1.88E+01
58.0E+01	59.0E+01	19.1E+01	3.35E+04	3.35E+04	1.89E+01	1.89E+01	1.89E+01
60.0E+01	61.0E+01	19.2E+01	3.46E+04	3.46E+04	1.90E+01	1.90E+01	1.90E+01
62.0E+01	63.0E+01	19.3E+01	3.57E+04	3.57E+04	1.91E+01	1.91E+01	1.91E+01
64.0E+01	65.0E+01	19.4E+01	3.68E+04	3.68E+04	1.92E+01	1.92E+01	1.92E+01
66.0E+01	67.0E+01	19.5E+01	3.79E+04	3.79E+04	1.93E+01	1.93E+01	1.93E+01
68.0E+01	69.0E+01	19.6E+01	3.90E+04	3.90E+04	1.94E+01	1.94E+01	1.94E+01
70.0E+01	71.0E+01	19.7E+01	4.01E+04	4.01E+04	1.95E+01	1.95E+01	1.95E+01
72.0E+01	73.0E+01	19.8E+01	4.12E+04	4.12E+04	1.96E+01	1.96E+01	1.96E+01
74.0E+01	75.0E+01	19.9E+01	4.23E+04	4.23E+04	1.97E+01	1.97E+01	1.97E+01
76.0E+01	77.0E+01	20.0E+01	4.34E+04	4.34E+04	1.98E+01	1.98E+01	1.98E+01
78.0E+01	79.0E+01	20.1E+01	4.45E+04	4.45E+04	1.99E+01	1.99E+01	1.99E+01
80.0E+01	81.0E+01	20.2E+01	4.56E+04	4.56E+04	2.00E+01	2.00E+01	2.00E+01
82.0E+01	83.0E+01	20.3E+01	4.67E+04	4.67E+04	2.01E+01	2.01E+01	2.01E+01
84.0E+01	85.0E+01	20.4E+01	4.78E+04	4.78E+04	2.02E+01	2.02E+01	2.02E+01
86.0E+01	87.0E+01	20.5E+01	4.89E+04	4.89E+04	2.03E+01	2.03E+01	2.03E+01
88.0E+01	89.0E+01	20.6E+01	4.99E+04	4.99E+04	2.04E+01	2.04E+01	2.04E+01
90.0E+01	91.0E+01	20.7E+01	5.10E+04	5.10E+04	2.05E+01	2.05E+01	2.05E+01
92.0E+01	93.0E+01	20.8E+01	5.21E+04	5.21E+04	2.06E+01	2.06E+01	2.06E+01
94.0E+01	95.0E+01	20.9E+01	5.32E+04	5.32E+04	2.07E+01	2.07E+01	2.07E+01
96.0E+01	97.0E+01	21.0E+01	5.43E+04	5.43E+04	2.08E+01	2.08E+01	2.08E+01
98.0E+01	99.0E+01	21.1E+01	5.54E+04	5.54E+04	2.09E+01	2.09E+01	2.09E+01
100.0E+01	101.0E+01	21.2E+01	5.65E+04	5.65E+04	2.10E+01	2.10E+01	2.10E+01
102.0E+01	103.0E+01	21.3E+01	5.76E+04	5.76E+04	2.11E+01	2.11E+01	2.11E+01
104.0E+01	105.0E+01	21.4E+01	5.87E+04	5.87E+04	2.12E+01	2.12E+01	2.12E+01
106.0E+01	107.0E+01	21.5E+01	5.98E+04	5.98E+04	2.13E+01	2.13E+01	2.13E+01
108.0E+01	109.0E+01	21.6E+01	6.09E+04	6.09E+04	2.14E+01	2.14E+01	2.14E+01
110.0E+01	111.0E+01	21.7E+01	6.20E+04	6.20E+04	2.15E+01	2.15E+01	2.15E+01
112.0E+01	113.0E+01	21.8E+01	6.31E+04	6.31E+04	2.16E+01	2.16E+01	2.16E+01
114.0E+01	115.0E+01	21.9E+01	6.42E+04	6.42E+04	2.17E+01	2.17E+01	2.17E+01
116.0E+01	117.0E+01	22.0E+01	6.53E+04	6.53E+04	2.18E+01	2.18E+01	2.18E+01
118.0E+01	119.0E+01	22.1E+01	6.64E+04	6.64E+04	2.19E+01	2.19E+01	2.19E+01
120.0E+01	121.0E+01	22.2E+01	6.75E+04	6.75E+04	2.20E+01	2.20E+01	2.20E+01
122.0E+01	123.0E+01	22.3E+01	6.86E+04	6.86E+04	2.21E+01	2.21E+01	2.21E+01
124.0E+01	125.0E+01	22.4E+01	6.97E+04	6.97E+04	2.22E+01	2.22E+01	2.22E+01
126.0E+01	127.0E+01	22.5E+01	7.08E+04	7.08E+04	2.23E+01	2.23E+01	2.23E+01
128.0E+01	129.0E+01	22.6E+01	7.19E+04	7.19E+04	2.24E+01	2.24E+01	2.24E+01
130.0E+01	131.0E+01	22.7E+01	7.30E+04	7.30E+04	2.25E+01	2.25E+01	2.25E+01
132.0E+01	133.0E+01	22.8E+01	7.41E+04	7.41E+04	2.26E+01	2.26E+01	2.26E+01
134.0E+01	135.0E+01	22.9E+01	7.52E+04	7.52E+04	2.27E+01	2.27E+01	2.27E+01
136.0E+01	137.0E+01	23.0E+01	7.63E+04	7.63E+04	2.28E+01	2.28E+01	2.28E+01
138.0E+01	139.0E+01	23.1E+01	7.74E+04	7.74E+04	2.29E+01	2.29E+01	2.29E+01
140.0E+01	141.0E+01	23.2E+01	7.85E+04	7.85E+04	2.30E+01	2.30E+01	2.30E+01
142.0E+01	143.0E+01	23.3E+01	7.96E+04	7.96E+04	2.31E+01	2.31E+01	2.31E+01
144.0E+01	145.0E+01	23.4E+01	8.07E+04	8.07E+04	2.32E+01	2.32E+01	2.32E+01
146.0E+01	147.0E+01	23.5E+01	8.18E+04	8.18E+04	2.33E+01	2.33E+01	2.33E+01
148.0E+01	149.0E+01	23.6E+01	8.29E+04	8.29E+04	2.34E+01	2.34E+01	2.34E+01
150.0E+01	151.0E+01	23.7E+01	8.40E+04	8.40E+04	2.35E+01	2.35E+01	2.35E+01
152.0E+01	153.0E+01	23.8E+01	8.51E+04	8.51E+04	2.36E+01	2.36E+01	2.36E+01
154.0E+01	155.0E+01	23.9E+01	8.62E+04	8.62E+04	2.37E+01	2.37E+01	2.37E+01
156.0E+01	157.0E+01	24.0E+01	8.73E+04	8.73E+04	2.38E+01	2.38E+01	2.38E+01
158.0E+01	159.0E+01	24.1E+01	8.84E+04	8.84E+04	2.39E+01	2.39E+01	2.39E+01
160.0E+01	161.0E+01	24.2E+01	8.95E+04	8.95E+04	2.40E+01	2.40E+01	2.40E+01
162.0E+01	163.0E+01	24.3E+01	9.06E+04	9.06E+04	2.41E+01	2.41E+01	2.41E+01
164.0E+01	165.0E+01	24.4E+01	9.17E+04	9.17E+04	2.42E+01	2.42E+01	2.42E+01
166.0E+01	167.0E+01	24.5E+01	9.28E+04	9.28E+04	2.43E+01	2.43E+01	2.43E+01
168.0E+01	169.0E+01	24.6E+01	9.39E+04	9.39E+04	2.44E+01	2.44E+01	2.44E+01
170.0E+01	171.0E+01	24.7E+01	9.50E+04	9.50E+04	2.45E+01	2.45E+01	2.45E+01
172.0E+01	173.0E+01	24.8E+01	9.61E+04	9.61E+04	2.46E+01	2.46E+01	2.46E+01
174.0E+01	175.0E+01	24.9E+01	9.72E+04	9.72E+04	2.47E+01	2.47E+01	2.47E+01
176.0E+01	177.0E+01	25.0E+01	9.83E+04	9.83E+04	2.48E+01	2.48E+01	2.48E+01
178.0E+01	179.0E+01	25.1E+01	9.94E+04	9.94E+04	2.49E+01	2.49E+01	2.49E+01
180.0E+01	181.0E+01	25.2E+01	1.005E+05	1.005E+05	2.50E+01	2.50E+01	2.50E+01
182.0E+01	183.0E+01	25.3E+01	1.016E+05	1.016E+05	2.51E+01	2.51E+01	2.51E+01
184.0E+01	185.0E+01	25.4E+01	1.027E+05	1.027E+05	2.52E+01	2.52E+01	2.52E+01
186.0E+01	187.0E+01	25.5E+01	1.038E+05	1.038E+05	2.53E+01	2.53E+01	2.53E+01
188.0E+01	189.0E+01	25.6E+01	1.049E+05	1.049E+05	2.54E+01	2.54E+01	2.54E+01
190.0E+01	191.0E+01	25.7E+01	1.060E+05	1.060E+05	2.55E+01	2.55E+01	2.55E+01
192.0E+01	193.0E+01	25.8E+01	1.071E+05	1.071E+05	2.56E+01	2.56E+01	2.56E+01
194.0E+01	195.0E+01	25.9E+01	1.082E+05	1.082E+05	2.57E+01	2.57E+01	2.57E+01
196.0E+01	197.0E+01	26.0E+01	1.093E+05	1.093E+05	2.58E+01	2.58E+01	2.58E+01
198.0E+01	199.0E+01	26.1E+01	1.104E+05	1.104E+05	2.59E+01	2.59E+01	2.59E+01
200.0E+01	201.0E+01	26.2E+01	1.115E+05	1.115E+05	2.60E+01	2.60E+01	2.60E+01
202.0E+01	203.0E+01	26.3E+01	1.126E+05	1.126E+05	2.61E+01	2.61E+01	2.61E+01
204.0E+01	205.0E+01	26.4E+01	1.137E+05	1.137E+05	2.62E+01	2.62E+01	2.62E+01
206.0E+01	207.0E+01	26.5E+01	1.148E+05	1.148E+05	2.63E+01	2.63E+01	2.63E+01
208.0E+01	209.0E+01	26.6E+01	1.159E+05	1.159E+05	2.64E+01	2.64E+01	2.64E+01
210.0E+01	211.0E+01	26.7E+01	1.170E+05	1.170E+05	2.65E+01	2.65E+01	2.65E+01
212.0E+01	213.0E+01	26.8E+01	1.181E+05	1.181E+05	2.66E+01	2.66E+01	2.66E+01
214.0E+01	215.0E+01	26.9E+01	1.192E+05	1.192E+05	2.67E+01	2.67E+01	2.67E+01
216.0E+01	217.0E+01	27.0E+01	1.203E+05	1.203E+05	2.68E+01	2.68E+01	2.68E+01
218.0E+01	21						

Table Ic

IRON

Atomic Collisions

E (GeV)	P (GeV/c)	DF/DX-TOT (MEV/GM/CM ² SQ)	RANGE (GM/CM ² SQ)	(CM)	(FT)	COLLISION PAIR PROB (ALL IN MEV/GM/CM ² SQ)	DF/DX-PARTIAL RADIATRIL NUCLEAR
900F+02	.901F+02	.214F+01	.441F+05	.561F+04	.144E+03	.214E+01	.221E+00
950F+02	.951F+02	.214F+01	.464F+05	.591F+04	.194E+03	.214E+01	.235E+00
1000F+03	.100F+03	.215F+01	.487F+05	.620F+04	.203E+03	.215E+01	.250E+00
1050F+03	.105F+03	.215F+01	.511F+05	.650F+04	.213E+03	.215E+01	.264E+00
1100F+03	.110F+03	.216F+01	.534F+05	.679F+04	.223E+03	.216E+01	.279E+00
1150F+03	.115F+03	.216F+01	.557F+05	.709F+04	.233E+03	.216E+01	.303E+00
1200F+03	.120F+03	.216F+01	.580F+05	.734F+04	.242E+03	.216E+01	.323E+00
1250F+03	.125F+03	.217F+01	.603F+05	.768F+04	.252E+03	.217E+01	.354E+00
1300F+03	.130F+03	.217F+01	.626F+05	.797F+04	.261E+03	.217E+01	.380E+00
1350F+03	.135F+03	.217F+01	.649F+05	.826F+04	.271E+03	.217E+01	.403E+00
1400F+03	.140F+03	.217F+01	.672F+05	.856F+04	.281E+03	.217E+01	.427E+00
1450F+03	.145F+03	.218F+01	.695F+05	.885F+04	.290E+03	.218E+01	.451E+00
1500F+03	.150F+03	.218F+01	.718F+05	.914F+04	.300E+03	.218E+01	.475E+00
1550F+03	.155F+03	.218F+01	.741F+05	.943F+04	.309F+03	.218E+01	.500E+00
1600F+03	.160F+03	.218F+01	.764F+05	.972F+04	.319F+03	.218E+01	.523E+00
1650F+03	.165F+03	.219E+01	.787F+05	.100E+05	.329F+03	.219E+01	.545E+00
1700F+03	.170F+03	.219F+01	.810F+05	.103E+05	.338F+03	.219E+01	.568E+00
1750F+03	.175F+03	.219F+01	.833F+05	.106E+05	.348F+03	.219F+01	.593E+00
1800F+03	.180F+03	.219F+01	.856F+05	.109E+05	.357F+03	.219F+01	.618E+00
1850F+03	.185F+03	.220F+01	.878F+05	.112F+05	.357E+03	.220E+01	.642E+00
1900F+03	.190F+03	.220F+01	.901F+05	.115F+05	.376F+03	.220F+01	.667E+00
1950F+03	.195F+03	.220F+01	.924F+05	.118F+05	.386F+03	.220F+01	.692E+00
2000F+03	.200F+03	.220F+01	.947F+05	.120E+05	.395F+03	.220E+01	.717E+00
2100F+03	.210F+03	.221F+01	.992F+05	.126E+05	.414E+03	.221E+01	.742E+00
2200F+03	.220F+03	.221F+01	.104E+06	.132E+05	.433E+03	.221E+01	.767E+00
2300F+03	.230F+03	.221F+01	.108E+06	.138E+05	.452E+03	.221E+01	.792E+00
2400F+03	.240F+03	.222F+01	.113E+06	.143F+05	.471E+03	.222E+01	.817E+00
2500F+03	.250F+03	.222F+01	.117E+06	.149F+05	.490E+03	.222E+01	.842E+00
2600F+03	.260F+03	.222F+01	.122E+06	.155E+05	.508E+03	.222E+01	.867E+00
2700F+03	.270F+03	.222F+01	.126E+06	.161F+05	.527E+03	.222E+01	.892E+00
2800F+03	.280F+03	.223F+01	.131F+06	.166F+05	.546E+03	.223E+01	.917E+00
2900F+03	.290F+03	.223F+01	.135F+06	.172E+05	.565E+03	.223E+01	.942E+00
3000F+03	.300F+03	.223F+01	.140F+06	.178E+05	.583E+03	.223E+01	.967E+00
3100F+03	.310F+03	.223F+01	.144F+06	.184E+05	.602E+03	.223E+01	.992E+00
3200F+03	.320F+03	.224F+01	.149F+06	.189E+05	.621E+03	.224E+01	.1017E+00
3300F+03	.330F+03	.224F+01	.153F+06	.195F+05	.639F+03	.224E+01	.1042E+00
3400F+03	.340F+03	.224F+01	.158E+06	.201E+05	.658F+03	.224E+01	.1067E+00
3500F+03	.350F+03	.224F+01	.162F+06	.206E+05	.677E+03	.224E+01	.1092E+00
3600F+03	.360F+03	.225F+01	.167F+06	.212E+05	.695E+03	.225E+01	.1108E+00
3700F+03	.370F+03	.225F+01	.171F+06	.214E+05	.714E+03	.226E+01	.1124E+00
3800F+03	.380F+03	.225F+01	.175F+06	.223E+05	.732E+03	.226E+01	.115F+01
3900F+03	.390F+03	.225F+01	.180F+06	.229F+05	.751E+03	.225E+01	.118F+01
4000F+03	.400F+03	.225F+01	.184E+06	.235E+05	.769E+03	.225E+01	.122F+01
4100F+03	.410F+03	.225F+01	.189F+06	.240E+05	.788E+03	.225E+01	.124E+01
4200F+03	.420F+03	.226F+01	.193F+06	.246E+05	.806E+03	.226E+01	.127E+01
4300F+03	.430F+03	.226F+01	.198E+06	.251F+05	.825E+03	.226E+01	.130E+01
4400F+03	.440F+03	.226F+01	.202E+06	.257F+05	.843E+03	.226E+01	.134E+01
4500F+03	.450F+03	.226F+01	.206E+06	.263F+05	.862E+03	.226E+01	.137E+01
4600F+03	.460F+03	.226F+01	.211F+06	.268F+05	.881E+03	.226E+01	.140E+01
4700F+03	.470F+03	.226F+01	.215F+06	.274F+05	.899E+03	.226E+01	.143E+01
4800F+03	.480F+03	.227F+01	.220E+06	.280E+05	.917E+03	.227E+01	.147E+01
4900F+03	.490F+03	.227F+01	.224E+06	.285E+05	.936E+03	.227E+01	.150E+01
5000F+03	.500F+03	.227F+01	.229E+06	.291F+05	.954E+03	.227E+01	.153E+01
5200F+03	.520F+03	.227F+01	.237F+06	.302F+05	.991E+03	.227E+01	.159E+01
5400F+03	.540F+03	.227E+01	.246E+06	.313E+05	.103E+04	.227E+01	.171E+01
5600F+03	.560F+03	.228E+01	.255E+06	.324F+05	.106E+04	.228E+01	.178E+01

Table 1d

IRON
Atomic Collisions

E	P	DE/DX-TOT	RANGE	COLLISION	PAIR PROD	DE/DX-PARTIAL (ALL IN MEV/GM/CMSQ)	BREMSSTRAHL	NUCLEAR
(GEV)	(GFV/C)	(MEV/GM/CMSQ)	(GM/GM/CMSQ)	(CM)	(FT)			
.580F+03	.580E+03	.228F+01	.264F+05	.336E+05	.110E+04	.228F+01	.179E+01	.423E+00
.600F+03	.600E+03	.228F+01	.273E+06	.347E+05	.114E+04	.228F+01	.185E+01	.438E+00
.620F+03	.620E+03	.228F+01	.281E+06	.358E+05	.117E+04	.228F+01	.192E+01	.453E+00
.640F+03	.640E+03	.229F+01	.290E+06	.369E+05	.121E+04	.229F+01	.198E+01	.467E+00
.660F+03	.660E+03	.229F+01	.299E+06	.380E+05	.125E+04	.229F+01	.205E+01	.482E+00
.680F+03	.680E+03	.229F+01	.307E+06	.391E+05	.128E+04	.229F+01	.211E+01	.496E+00
.700F+03	.700E+03	.229F+01	.316E+06	.402E+05	.132E+04	.229F+01	.218E+01	.511E+00
.720F+03	.720E+03	.230F+01	.325E+06	.413E+05	.136E+04	.230F+01	.224E+01	.526E+00
.740F+03	.740E+03	.230F+01	.334E+06	.424E+05	.139E+04	.230F+01	.231E+01	.540E+00
.760F+03	.760E+03	.230F+01	.342E+06	.436E+05	.143E+04	.230F+01	.237E+01	.555E+00
.780F+03	.780E+03	.230F+01	.351E+06	.447E+05	.147E+04	.230F+01	.244E+01	.569E+00
.800F+03	.800E+03	.230F+01	.360E+06	.458E+05	.150E+04	.230F+01	.250E+01	.584E+00
.820F+03	.820E+03	.231F+01	.368E+06	.469E+05	.154E+04	.231F+01	.257E+01	.599E+00
.840F+03	.840E+03	.231F+01	.377E+06	.480E+05	.157E+04	.231F+01	.263E+01	.614E+00
.860F+03	.860E+03	.231F+01	.386E+06	.491E+05	.161E+04	.231F+01	.270E+01	.628E+00
.880F+03	.880E+03	.231F+01	.394E+06	.502E+05	.165E+04	.231F+01	.276E+01	.642E+00
.900F+03	.900E+03	.231F+01	.403E+06	.513E+05	.168E+04	.231F+01	.283E+01	.657E+00
.920F+03	.920E+03	.231F+01	.412E+06	.524E+05	.172F+04	.231F+01	.290E+01	.672E+00
.940F+03	.940E+03	.231F+01	.420E+06	.535E+05	.175F+04	.231F+01	.296E+01	.686E+00
.960F+03	.960E+03	.232F+01	.429E+06	.546E+05	.179F+04	.232E+01	.303E+01	.701E+00
.980F+03	.980E+03	.232F+01	.438E+06	.557E+05	.183E+04	.232E+01	.309E+01	.715E+00
.1000F+04	.100E+04	.232F+01	.446E+06	.568E+05	.186E+04	.232E+01	.316E+01	.730E+00
.1020F+04	.102E+04	.232F+01	.455E+06	.579E+05	.190E+04	.232E+01	.323E+01	.745E+00
.1040F+04	.104E+04	.232F+01	.464E+06	.591E+05	.194E+04	.232E+01	.330E+01	.760E+00
.1060F+04	.106E+04	.232E+01	.473E+06	.602E+05	.198E+04	.232E+01	.337E+01	.775E+00
.1080F+04	.108E+04	.233E+01	.483E+06	.614E+05	.202E+04	.233E+01	.344E+01	.792E+00
.1100F+04	.110E+04	.233E+01	.492E+06	.626E+05	.206E+04	.233E+01	.351E+01	.808E+00

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Table 2a
SOIL
Atomic Collisions

Table 2b
SOIL
Atomic Collisions

P	F	DE/DX-TOT (MFV/GVN50)	DE/DX-BR (GV/CVN50)	RANGE (CM)	COLLISION PAIR PROD. (ALL IN GV/GMV)		NUCLEAR (GV/GMV)
					LEFT	RIGHT	
		18.8E+01	1.34E+04	6.71E+03	1.8E+01	1.8E+01	1.75E-02
		18.9E+01	1.45E+04	7.24E+03	1.9E+02	1.89E+01	1.90E-02
		19.0E+01	1.55E+04	7.76E+03	2.37E+02	1.90E+01	2.02E-02
		19.1E+01	1.65E+04	8.29E+03	2.55E+02	1.90E+01	2.13E-02
		19.2E+01	1.74E+04	8.82E+03	2.62E+02	1.91E+01	2.23E-02
		19.3E+01	1.83E+04	9.35E+03	2.69E+02	1.92E+01	2.33E-02
		19.4E+01	1.92E+04	9.88E+03	2.76E+02	1.93E+01	2.43E-02
		19.5E+01	2.01E+04	1.04E+04	2.83E+02	1.94E+01	2.53E-02
		19.6E+01	2.10E+04	1.10E+04	2.90E+02	1.95E+01	2.63E-02
		19.7E+01	2.19E+04	1.16E+04	2.97E+02	1.96E+01	2.73E-02
		19.8E+01	2.28E+04	1.22E+04	3.04E+02	1.97E+01	2.83E-02
		19.9E+01	2.37E+04	1.28E+04	3.11E+02	1.98E+01	2.93E-02
		20.0E+01	2.46E+04	1.34E+04	3.18E+02	1.99E+01	3.03E-02
		20.1E+01	2.55E+04	1.40E+04	3.25E+02	2.00E+01	3.13E-02
		20.2E+01	2.64E+04	1.46E+04	3.32E+02	2.01E+01	3.23E-02
		20.3E+01	2.73E+04	1.52E+04	3.39E+02	2.02E+01	3.33E-02
		20.4E+01	2.82E+04	1.58E+04	3.46E+02	2.03E+01	3.43E-02
		20.5E+01	2.91E+04	1.64E+04	3.53E+02	2.04E+01	3.53E-02
		20.6E+01	3.00E+04	1.70E+04	3.60E+02	2.05E+01	3.63E-02
		20.7E+01	3.09E+04	1.76E+04	3.67E+02	2.06E+01	3.73E-02
		20.8E+01	3.18E+04	1.82E+04	3.74E+02	2.07E+01	3.83E-02
		20.9E+01	3.27E+04	1.88E+04	3.81E+02	2.08E+01	3.93E-02
		21.0E+01	3.36E+04	1.94E+04	3.88E+02	2.09E+01	4.03E-02
		21.1E+01	3.45E+04	2.00E+04	3.95E+02	2.10E+01	4.13E-02
		21.2E+01	3.54E+04	2.06E+04	4.02E+02	2.11E+01	4.23E-02
		21.3E+01	3.63E+04	2.12E+04	4.09E+02	2.12E+01	4.33E-02
		21.4E+01	3.72E+04	2.18E+04	4.16E+02	2.13E+01	4.43E-02
		21.5E+01	3.81E+04	2.24E+04	4.23E+02	2.14E+01	4.53E-02
		21.6E+01	3.90E+04	2.30E+04	4.30E+02	2.15E+01	4.63E-02
		21.7E+01	3.99E+04	2.36E+04	4.37E+02	2.16E+01	4.73E-02
		21.8E+01	4.08E+04	2.42E+04	4.44E+02	2.17E+01	4.83E-02
		21.9E+01	4.17E+04	2.48E+04	4.51E+02	2.18E+01	4.93E-02
		22.0E+01	4.26E+04	2.54E+04	4.58E+02	2.19E+01	5.03E-02
		22.1E+01	4.35E+04	2.60E+04	4.65E+02	2.20E+01	5.13E-02
		22.2E+01	4.44E+04	2.66E+04	4.72E+02	2.21E+01	5.23E-02
		22.3E+01	4.53E+04	2.72E+04	4.79E+02	2.22E+01	5.33E-02
		22.4E+01	4.62E+04	2.78E+04	4.86E+02	2.23E+01	5.43E-02
		22.5E+01	4.71E+04	2.84E+04	4.93E+02	2.24E+01	5.53E-02
		22.6E+01	4.80E+04	2.90E+04	5.00E+02	2.25E+01	5.63E-02
		22.7E+01	4.89E+04	2.96E+04	5.07E+02	2.26E+01	5.73E-02
		22.8E+01	4.98E+04	3.02E+04	5.14E+02	2.27E+01	5.83E-02
		22.9E+01	5.07E+04	3.08E+04	5.21E+02	2.28E+01	5.93E-02
		23.0E+01	5.16E+04	3.14E+04	5.28E+02	2.29E+01	6.03E-02
		23.1E+01	5.25E+04	3.20E+04	5.35E+02	2.30E+01	6.13E-02
		23.2E+01	5.34E+04	3.26E+04	5.42E+02	2.31E+01	6.23E-02
		23.3E+01	5.43E+04	3.32E+04	5.49E+02	2.32E+01	6.33E-02
		23.4E+01	5.52E+04	3.38E+04	5.56E+02	2.33E+01	6.43E-02
		23.5E+01	5.61E+04	3.44E+04	5.63E+02	2.34E+01	6.53E-02
		23.6E+01	5.70E+04	3.50E+04	5.70E+02	2.35E+01	6.63E-02
		23.7E+01	5.79E+04	3.56E+04	5.77E+02	2.36E+01	6.73E-02
		23.8E+01	5.88E+04	3.62E+04	5.84E+02	2.37E+01	6.83E-02
		23.9E+01	5.97E+04	3.68E+04	5.91E+02	2.38E+01	6.93E-02
		24.0E+01	6.06E+04	3.74E+04	5.98E+02	2.39E+01	7.03E-02
		24.1E+01	6.15E+04	3.80E+04	6.05E+02	2.40E+01	7.13E-02
		24.2E+01	6.24E+04	3.86E+04	6.12E+02	2.41E+01	7.23E-02
		24.3E+01	6.33E+04	3.92E+04	6.19E+02	2.42E+01	7.33E-02
		24.4E+01	6.42E+04	3.98E+04	6.26E+02	2.43E+01	7.43E-02
		24.5E+01	6.51E+04	4.04E+04	6.33E+02	2.44E+01	7.53E-02
		24.6E+01	6.60E+04	4.10E+04	6.40E+02	2.45E+01	7.63E-02
		24.7E+01	6.69E+04	4.16E+04	6.47E+02	2.46E+01	7.73E-02
		24.8E+01	6.78E+04	4.22E+04	6.54E+02	2.47E+01	7.83E-02
		24.9E+01	6.87E+04	4.28E+04	6.61E+02	2.48E+01	7.93E-02
		25.0E+01	6.96E+04	4.34E+04	6.68E+02	2.49E+01	8.03E-02
		25.1E+01	7.05E+04	4.40E+04	6.75E+02	2.50E+01	8.13E-02
		25.2E+01	7.14E+04	4.46E+04	6.82E+02	2.51E+01	8.23E-02
		25.3E+01	7.23E+04	4.52E+04	6.89E+02	2.52E+01	8.33E-02
		25.4E+01	7.32E+04	4.58E+04	6.96E+02	2.53E+01	8.43E-02
		25.5E+01	7.41E+04	4.64E+04	7.03E+02	2.54E+01	8.53E-02
		25.6E+01	7.50E+04	4.70E+04	7.10E+02	2.55E+01	8.63E-02
		25.7E+01	7.59E+04	4.76E+04	7.17E+02	2.56E+01	8.73E-02
		25.8E+01	7.68E+04	4.82E+04	7.24E+02	2.57E+01	8.83E-02
		25.9E+01	7.77E+04	4.88E+04	7.31E+02	2.58E+01	8.93E-02
		26.0E+01	7.86E+04	4.94E+04	7.38E+02	2.59E+01	9.03E-02
		26.1E+01	7.95E+04	5.00E+04	7.45E+02	2.60E+01	9.13E-02
		26.2E+01	8.04E+04	5.06E+04	7.52E+02	2.61E+01	9.23E-02
		26.3E+01	8.13E+04	5.12E+04	7.59E+02	2.62E+01	9.33E-02
		26.4E+01	8.22E+04	5.18E+04	7.66E+02	2.63E+01	9.43E-02
		26.5E+01	8.31E+04	5.24E+04	7.73E+02	2.64E+01	9.53E-02
		26.6E+01	8.40E+04	5.30E+04	7.80E+02	2.65E+01	9.63E-02
		26.7E+01	8.49E+04	5.36E+04	7.87E+02	2.66E+01	9.73E-02
		26.8E+01	8.58E+04	5.42E+04	7.94E+02	2.67E+01	9.83E-02
		26.9E+01	8.67E+04	5.48E+04	8.01E+02	2.68E+01	9.93E-02
		27.0E+01	8.76E+04	5.54E+04	8.08E+02	2.69E+01	1.003E-01
		27.1E+01	8.85E+04	5.60E+04	8.15E+02	2.70E+01	1.013E-01
		27.2E+01	8.94E+04	5.66E+04	8.22E+02	2.71E+01	1.023E-01
		27.3E+01	9.03E+04	5.72E+04	8.29E+02	2.72E+01	1.033E-01
		27.4E+01	9.12E+04	5.78E+04	8.36E+02	2.73E+01	1.043E-01
		27.5E+01	9.21E+04	5.84E+04	8.43E+02	2.74E+01	1.053E-01
		27.6E+01	9.30E+04	5.90E+04	8.50E+02	2.75E+01	1.063E-01
		27.7E+01	9.39E+04	5.96E+04	8.57E+02	2.76E+01	1.073E-01
		27.8E+01	9.48E+04	6.02E+04	8.64E+02	2.77E+01	1.083E-01
		27.9E+01	9.57E+04	6.08E+04	8.71E+02	2.78E+01	1.093E-01
		28.0E+01	9.66E+04	6.14E+04	8.78E+02	2.79E+01	1.103E-01
		28.1E+01	9.75E+04	6.20E+04	8.85E+02	2.80E+01	1.113E-01
		28.2E+01	9.84E+04	6.26E+04	8.92E+02	2.81E+01	1.123E-01
		28.3E+01	9.93E+04	6.32E+04	8.99E+02	2.82E+01	1.133E-01
		28.4E+01	1.002E+05	6.38E+04	9.06E+02	2.83E+01	1.143E-01
		28.5E+01	1.011E+05	6.44E+04	9.13E+02	2.84E+01	1.153E-01
		28.6E+01	1.020E+05	6.50E+04	9.20E+02	2.85E+01	1.163E-01
		28.7E+01	1.029E+05	6.56E+04	9.27E+02	2.86E+01	1.173E-01
		28.8E+01	1.038E+05	6.62E+04	9.34E+02	2.87E+01	1.183E-01
		28.9E+01	1.047E+05	6.68E+04	9.41E+02	2.88E+01	1.193E-01
		29.0E+01	1.056E+05	6.74E+04	9.48E+02	2.89E+01	1.203E-01
		29.1E+01	1.065E+05	6.80E+04	9.55E+02	2.90E+01	1.213E-01
		29.2E+01	1.074E+05	6.86E+04	9.62E+02	2.91E+01	1.223E-01
		29.3E+01	1.083E+05	6.92E+04	9.69E+02	2.92E+01	1.233E-01
		29.4E+01	1.092E+05	6.98E+04	9.76E+02	2.93E+01	1.243E-01
		29.5E+01	1.101E+05	7.04E+04	9.83E+02	2.94E+01	1.253E-01
		29.6E+01	1.110E+05	7.10E+04	9.90E+02	2.95E+01	1.263E-01
		29.7E+01	1.119E+05	7.16E+04	9.97E+02	2.96E+01	1.273E-01
		29.8E+01	1.128E+05	7.22E+04	1.004E+03	2.97E+01	1.283E-01
		29.9E+01	1.137E+05	7.28E+04	1.011E+03	2.98E+01	1.293E-01
		30.0E+01	1.146E+05	7.34E+04	1.018E+03	2.99E+01	1.303E-01
		30.1E+01	1.155E+05	7.40E+04	1.025E+03	3.00E+01	1.313E-01
		30.2E+01	1.164E+05	7.46E+04	1.032E+03	3.01E+01	1.323E-01
		30.					

Table 2c

SOIL

Atomic Collisions

E (GeV)	P (GeV/C)	DF/DX-TOT (MeV/GM/CM50)	RANGE (GeV/C450)	(cm)	(ft)	COLLISION (ALL IN CM)	PAIR PROD DF/DX-PARTIAL (ALL IN MEV/GM/CM50)	PAIR STRAL DF/DX-PARTIAL (ALL IN MEV/GM/CM50)	NUCLEAR
.900E+02	.901E+02	.228F+01	.412F+05	.206E+05	.676F+03	.228F+01	.106F+00	.344F+01	.657E-01
.950E+02	.951E+02	.229F+01	.434F+05	.217F+05	.712F+03	.229F+01	.112E+00	.180F+00	.693E-01
.100E+03	.100E+03	.234F+01	.456F+05	.228E+05	.747F+03	.229F+01	.119F+00	.102E+00	.730E-01
.105E+03	.105E+03	.230F+01	.477F+05	.239E+05	.783F+03	.230F+01	.125E+00	.113E+00	.765E-01
.110E+03	.110E+03	.230F+01	.499F+05	.250F+05	.819F+03	.230F+01	.132E+00	.119F+00	.833E-01
.115E+03	.115E+03	.230F+01	.521F+05	.260F+05	.854F+03	.230F+01	.138E+00	.125F+00	.839E-01
.120E+03	.120E+03	.231F+01	.543F+05	.271F+05	.890E+03	.231F+01	.145F+00	.131F+00	.876E-01
.125E+03	.125E+03	.231F+01	.564F+05	.282F+05	.926F+03	.231E+01	.152E+00	.138F+00	.912E-01
.130E+03	.130E+03	.231F+01	.586E+05	.293E+05	.961F+03	.231E+01	.158E+00	.144F+00	.949E-01
.135E+03	.135E+03	.232F+01	.607F+05	.304F+05	.996E+03	.232F+01	.165F+00	.150F+00	.985E-01
.140E+03	.140E+03	.232F+01	.629E+05	.315E+05	.103E+04	.232F+01	.171E+00	.157F+00	.102E+00
.145E+03	.145E+03	.232F+01	.651F+05	.325E+05	.107E+04	.232F+01	.178E+00	.163F+00	.109E+00
.150E+03	.150E+03	.232F+01	.672F+05	.336F+05	.110E+04	.232E+01	.184E+00	.170F+00	.117E+00
.155E+03	.155E+03	.233F+01	.694F+05	.347F+05	.114E+04	.233F+01	.191F+00	.176E+00	.120E+00
.160E+03	.160E+03	.233F+01	.715F+05	.358F+05	.117E+04	.233F+01	.198E+00	.183F+00	.124E+00
.165E+03	.165E+03	.233F+01	.737E+05	.363E+05	.121E+04	.233F+01	.204E+00	.195F+00	.128E+00
.170E+03	.170E+03	.233F+01	.758E+05	.379F+05	.124E+04	.233E+01	.211F+00	.202F+00	.131E+00
.175E+03	.175E+03	.234E+01	.779E+05	.390F+05	.128E+04	.234E+01	.218E+00	.209F+00	.135E+00
.180E+03	.180E+03	.234E+01	.801E+05	.400F+05	.131E+04	.234E+01	.224F+00	.216F+00	.139E+00
.185E+03	.185E+03	.234E+01	.822E+05	.411E+05	.135E+04	.234E+01	.231E+00	.222F+00	.142E+00
.190E+03	.190E+03	.234E+01	.844E+05	.422F+05	.138E+04	.234E+01	.238E+00	.229F+00	.146E+00
.195E+03	.195E+03	.234F+01	.865E+05	.432F+05	.142E+04	.234E+01	.244F+00	.236F+00	.150E+00
.200E+03	.200E+03	.235F+01	.886E+05	.443F+05	.145E+04	.235E+01	.251F+00	.249F+00	.153E+00
.210E+03	.210E+03	.235F+01	.907E+05	.464F+05	.152E+04	.235E+01	.265E+00	.263F+00	.168E+00
.220E+03	.220E+03	.235F+01	.929E+05	.485F+05	.159E+04	.235E+01	.278E+00	.276E+00	.175E+00
.230E+03	.230E+03	.236F+01	.971F+05	.507F+05	.166E+04	.236E+01	.291E+00	.290E+00	.182E+00
.240E+03	.240E+03	.236F+01	.101E+06	.528F+05	.173E+04	.236E+01	.305E+00	.304E+00	.190E+00
.250E+03	.250E+03	.236F+01	.106E+06	.549E+05	.180E+04	.236E+01	.315E+00	.317E+00	.197E+00
.260E+03	.260E+03	.237F+01	.110E+06	.570F+05	.187E+04	.237E+01	.322F+00	.331F+00	.204E+00
.270E+03	.270E+03	.237F+01	.114E+06	.592F+05	.194E+04	.237E+01	.346E+00	.346E+00	.210E+00
.280E+03	.280E+03	.237F+01	.118E+06	.613F+05	.201E+04	.237E+01	.359E+00	.359E+00	.216E+00
.290E+03	.290E+03	.237F+01	.127E+06	.634E+05	.208E+04	.237E+01	.373E+00	.373E+00	.221E+00
.300E+03	.300E+03	.238F+01	.131F+06	.655E+05	.215E+04	.238F+01	.386E+00	.373E+00	.226E+00
.310E+03	.310E+03	.238F+01	.135E+06	.676E+05	.222F+04	.238E+01	.400E+00	.387E+00	.234E+00
.320E+03	.320E+03	.238F+01	.139E+06	.697F+05	.229E+04	.238E+01	.414E+00	.401E+00	.241E+00
.330E+03	.330E+03	.238F+01	.144E+06	.718F+05	.235E+04	.238E+01	.427E+00	.416E+00	.248E+00
.340E+03	.340E+03	.239F+01	.148E+06	.739F+05	.242F+04	.239E+01	.441E+00	.430E+00	.255E+00
.350E+03	.350E+03	.239F+01	.152E+06	.760F+05	.256F+04	.239E+01	.455E+00	.444E+00	.263E+00
.360E+03	.360E+03	.239F+01	.156E+06	.781F+05	.263F+04	.239E+01	.469E+00	.457E+00	.270E+00
.370E+03	.370E+03	.239F+01	.160E+06	.801F+05	.263F+04	.239F+01	.482E+00	.473E+00	.277E+00
.380E+03	.380E+03	.239F+01	.164E+06	.822E+05	.270E+04	.239E+01	.496E+00	.487E+00	.285E+00
.390E+03	.390E+03	.240F+01	.169F+06	.843E+05	.277F+04	.240E+01	.510F+00	.502E+00	.292E+00
.400E+03	.400E+03	.240F+01	.173E+06	.864E+05	.293E+04	.240E+01	.524E+00	.516E+00	.299E+00
.410E+03	.410E+03	.240F+01	.177E+06	.885E+05	.290E+04	.240E+01	.538E+00	.531E+00	.307E+00
.420E+03	.420E+03	.240F+01	.181E+06	.906E+05	.297E+04	.240E+01	.551E+00	.545E+00	.314E+00
.430E+03	.430E+03	.240F+01	.185E+06	.927E+05	.304E+04	.240E+01	.565E+00	.560E+00	.321E+00
.440E+03	.440E+03	.241F+01	.189E+06	.947E+05	.311E+04	.241F+01	.579E+00	.589E+00	.328E+00
.450E+03	.450E+03	.241F+01	.194E+06	.968F+05	.318E+04	.241F+01	.593E+00	.604E+00	.343E+00
.460E+03	.460E+03	.241F+01	.198E+06	.989F+05	.324E+04	.241F+01	.621E+00	.619E+00	.358E+00
.470E+03	.470E+03	.241F+01	.202E+06	.101F+06	.331E+04	.241F+01	.635F+00	.634E+00	.374E+00
.480E+03	.480E+03	.241F+01	.206E+06	.103E+06	.334E+04	.241F+01	.648E+00	.649E+00	.385E+00
.490E+03	.490E+03	.241F+01	.210E+06	.105E+06	.345E+04	.241F+01	.662F+00	.663F+00	.395E+00
.500E+03	.500E+03	.242F+01	.214E+06	.107F+06	.352E+04	.242E+01	.690E+00	.693E+00	.404E+00
.520E+03	.520E+03	.242F+01	.223E+06	.111E+06	.365E+04	.242E+01	.718E+00	.723F+00	.394E+00
.540E+03	.540E+03	.242F+01	.231E+06	.115F+06	.379F+04	.242E+01	.746E+00	.753E+00	.409E+00
.560E+03	.560E+03	.242E+01	.239E+06	.120F+06	.392E+04				

Table 2d

SOIL Atomic Collisions

E	P	DE/DX-TOT	RANGE	COLLISION	PAIR PROD	DE/DX-PARTIAL	NUCLEAR		
(GFV)	(GFV/C)	(MEV/GM/GMSQ)	(GM/GMSQ)	(CH)	(FT)	(ALL IN MEV/GY/GMSQ)			
5.80E+03	5.80E+03	.243F+01	.247F+06	.124F+06	.406F+04	.243E+01	.774F+00	.783F+00	.423F+00
6.00E+03	6.00E+03	.243F+01	.256F+06	.128F+06	.419E+04	.243E+01	.802F+00	.814F+00	.433F+00
6.20E+03	6.20E+03	.243F+01	.264F+06	.132E+06	.433F+04	.243E+01	.830F+00	.844F+00	.453F+00
6.40E+03	6.40E+03	.243F+01	.272F+06	.136E+06	.446F+04	.243F+01	.858F+00	.875E+00	.467E+00
6.60E+03	6.60E+03	.244F+01	.280F+06	.140F+06	.460E+04	.244E+01	.886E+00	.905E+00	.482E+00
6.80E+03	6.80E+03	.244F+01	.289F+06	.144E+06	.473E+04	.244F+01	.914E+00	.936E+00	.496E+00
7.00E+03	7.00E+03	.244F+01	.297E+06	.148F+06	.487E+04	.244F+01	.943E+00	.967E+00	.511F+00
7.20E+03	7.20E+03	.244F+01	.305F+06	.152E+06	.500E+04	.244F+01	.971E+00	.998E+00	.526E+00
7.40E+03	7.40E+03	.244F+01	.313F+06	.157F+06	.514E+04	.244F+01	.999E+00	.103E+01	.540E+00
7.60E+03	7.60E+03	.245E+01	.321F+06	.161E+06	.527E+04	.245E+01	.103E+01	.106E+01	.555E+00
7.80E+03	7.80E+03	.245E+01	.329F+06	.165F+06	.540E+04	.245E+01	.106E+01	.109F+01	.569E+00
8.00E+03	8.00E+03	.245E+01	.338F+06	.169E+06	.554E+04	.245E+01	.108E+01	.112F+01	.584E+00
A20E+03	8.20E+03	.245E+01	.346E+06	.173E+06	.567E+04	.245E+01	.111E+01	.115E+01	.599E+00
8.40E+03	8.40E+03	.245E+01	.354F+06	.177F+06	.581E+04	.245E+01	.114E+01	.118F+01	.613E+00
8.60E+03	8.60E+03	.245E+01	.362F+06	.181F+06	.594E+04	.245E+01	.117E+01	.122F+01	.628E+00
8.80E+03	8.80E+03	.246E+01	.370F+06	.185E+06	.607E+04	.246F+01	.120E+01	.125F+01	.642E+00
9.00E+03	9.00E+03	.246E+01	.378F+06	.189F+06	.621E+04	.246E+01	.123E+01	.124E+01	.657E+00
9.20E+03	9.20E+03	.246E+01	.387F+06	.193E+06	.634E+04	.246E+01	.125E+01	.131E+01	.672E+00
9.40E+03	9.40E+03	.246E+01	.395F+06	.197E+06	.647E+04	.246E+01	.128E+01	.134F+01	.686E+00
9.60E+03	9.60E+03	.246E+01	.403F+06	.201E+06	.661E+04	.246F+01	.131E+01	.137F+01	.701E+00
9.80E+03	9.80E+03	.246F+01	.411F+06	.205E+06	.674E+04	.246F+01	.134E+01	.141E+01	.715E+00
1.00E+04	1.00E+04	.247F+01	.419E+06	.209E+06	.687E+04	.247E+01	.137E+01	.144E+01	.730E+00
1.02E+04	1.02E+04	.247E+01	.427F+06	.214E+06	.701E+04	.247E+01	.140E+01	.147E+01	.745E+00
1.04E+04	1.04E+04	.247E+01	.436F+06	.218E+06	.715E+04	.247E+01	.143E+01	.151E+01	.760E+00
1.06E+04	1.06E+04	.247E+01	.445E+06	.222F+06	.729E+04	.247E+01	.146E+01	.154E+01	.776E+00
1.08E+04	1.08E+04	.247E+01	.453E+06	.227F+06	.744E+04	.247E+01	.149E+01	.158E+01	.792E+00
1.10E+04	1.10E+04	.247E+01	.462E+06	.231E+06	.759E+04	.247E+01	.152E+01	.161E+01	.808E+00

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Table 3a
LEAD
Atomic Collision

Table 3b
LEAD
Atomic Collisions

P (GeV)	E (GeV)	DE/ΔX-TOT (MeV/cm ² /sr)	DE/ΔX-GN/GNSQ (GeV/cm ²)	COLLISION RANGE (cm)	PAIR PAIR (ALL)	DE/ΔX-PARTIAL IN 4EV/CN/GMSQ	NUCLEAR
24.0E+01	1.84E+04	1.61E+03	5.70E+01	1.42E+01	5.59E+02	1.75E+02	2.20E+02
25.0E+01	1.98E+04	1.74E+03	5.70E+01	1.42E+01	6.28E+02	1.90E+02	2.20E+02
26.0E+01	2.12E+04	1.86E+03	6.15E+01	1.42E+01	6.98E+02	2.07E+02	2.22E+02
27.0E+01	2.26E+04	1.98E+03	6.57E+01	1.42E+01	7.70E+02	2.24E+02	2.22E+02
28.0E+01	2.40E+04	2.10E+03	7.00E+01	1.42E+01	8.41E+02	2.41E+02	2.22E+02
29.0E+01	2.54E+04	2.22E+03	7.43E+01	1.42E+01	9.13E+02	2.58E+02	2.22E+02
30.0E+01	2.67E+04	2.34E+03	7.86E+01	1.42E+01	9.84E+02	2.75E+02	2.22E+02
31.0E+01	2.80E+04	2.46E+03	8.30E+01	1.42E+01	1.05E+03	2.92E+02	2.22E+02
32.0E+01	2.93E+04	2.58E+03	8.73E+01	1.42E+01	1.12E+03	3.09E+02	2.22E+02
33.0E+01	3.07E+04	2.70E+03	9.17E+01	1.42E+01	1.19E+03	3.26E+02	2.22E+02
34.0E+01	3.20E+04	2.82E+03	9.60E+01	1.42E+01	1.26E+03	3.43E+02	2.22E+02
35.0E+01	3.34E+04	2.94E+03	1.003E+02	1.42E+01	1.33E+03	3.60E+02	2.22E+02
36.0E+01	3.47E+04	3.06E+03	1.046E+02	1.42E+01	1.40E+03	3.77E+02	2.22E+02
37.0E+01	3.60E+04	3.18E+03	1.090E+02	1.42E+01	1.47E+03	3.94E+02	2.22E+02
38.0E+01	3.73E+04	3.30E+03	1.134E+02	1.42E+01	1.54E+03	4.11E+02	2.22E+02
39.0E+01	3.86E+04	3.42E+03	1.178E+02	1.42E+01	1.61E+03	4.28E+02	2.22E+02
40.0E+01	4.00E+04	3.54E+03	1.222E+02	1.42E+01	1.68E+03	4.45E+02	2.22E+02
41.0E+01	4.13E+04	3.66E+03	1.266E+02	1.42E+01	1.75E+03	4.62E+02	2.22E+02
42.0E+01	4.26E+04	3.78E+03	1.310E+02	1.42E+01	1.82E+03	4.79E+02	2.22E+02
43.0E+01	4.39E+04	3.90E+03	1.354E+02	1.42E+01	1.89E+03	4.96E+02	2.22E+02
44.0E+01	4.52E+04	4.02E+03	1.398E+02	1.42E+01	1.96E+03	5.13E+02	2.22E+02
45.0E+01	4.65E+04	4.14E+03	1.442E+02	1.42E+01	2.03E+03	5.30E+02	2.22E+02
46.0E+01	4.78E+04	4.26E+03	1.486E+02	1.42E+01	2.10E+03	5.47E+02	2.22E+02
47.0E+01	4.91E+04	4.38E+03	1.530E+02	1.42E+01	2.17E+03	5.64E+02	2.22E+02
48.0E+01	5.04E+04	4.50E+03	1.574E+02	1.42E+01	2.24E+03	5.81E+02	2.22E+02
49.0E+01	5.17E+04	4.62E+03	1.618E+02	1.42E+01	2.31E+03	5.98E+02	2.22E+02
50.0E+01	5.30E+04	4.74E+03	1.662E+02	1.42E+01	2.38E+03	6.15E+02	2.22E+02
51.0E+01	5.43E+04	4.86E+03	1.706E+02	1.42E+01	2.45E+03	6.32E+02	2.22E+02
52.0E+01	5.56E+04	4.98E+03	1.750E+02	1.42E+01	2.52E+03	6.49E+02	2.22E+02
53.0E+01	5.69E+04	5.10E+03	1.794E+02	1.42E+01	2.59E+03	6.66E+02	2.22E+02
54.0E+01	5.82E+04	5.22E+03	1.838E+02	1.42E+01	2.66E+03	6.83E+02	2.22E+02
55.0E+01	5.95E+04	5.34E+03	1.882E+02	1.42E+01	2.73E+03	7.00E+02	2.22E+02
56.0E+01	6.08E+04	5.46E+03	1.926E+02	1.42E+01	2.80E+03	7.17E+02	2.22E+02
57.0E+01	6.21E+04	5.58E+03	1.970E+02	1.42E+01	2.87E+03	7.34E+02	2.22E+02
58.0E+01	6.34E+04	5.70E+03	2.014E+02	1.42E+01	2.94E+03	7.51E+02	2.22E+02
59.0E+01	6.47E+04	5.82E+03	2.058E+02	1.42E+01	3.01E+03	7.68E+02	2.22E+02
60.0E+01	6.60E+04	5.94E+03	2.102E+02	1.42E+01	3.08E+03	7.85E+02	2.22E+02
61.0E+01	6.73E+04	6.06E+03	2.146E+02	1.42E+01	3.15E+03	8.02E+02	2.22E+02
62.0E+01	6.86E+04	6.18E+03	2.190E+02	1.42E+01	3.22E+03	8.19E+02	2.22E+02
63.0E+01	7.00E+04	6.30E+03	2.234E+02	1.42E+01	3.29E+03	8.36E+02	2.22E+02
64.0E+01	7.13E+04	6.42E+03	2.278E+02	1.42E+01	3.36E+03	8.53E+02	2.22E+02
65.0E+01	7.26E+04	6.54E+03	2.322E+02	1.42E+01	3.43E+03	8.70E+02	2.22E+02
66.0E+01	7.39E+04	6.66E+03	2.366E+02	1.42E+01	3.50E+03	8.87E+02	2.22E+02
67.0E+01	7.52E+04	6.78E+03	2.410E+02	1.42E+01	3.57E+03	9.04E+02	2.22E+02
68.0E+01	7.65E+04	6.90E+03	2.454E+02	1.42E+01	3.64E+03	9.21E+02	2.22E+02
69.0E+01	7.78E+04	7.02E+03	2.498E+02	1.42E+01	3.71E+03	9.38E+02	2.22E+02
70.0E+01	7.91E+04	7.14E+03	2.542E+02	1.42E+01	3.78E+03	9.55E+02	2.22E+02
71.0E+01	8.04E+04	7.26E+03	2.586E+02	1.42E+01	3.85E+03	9.72E+02	2.22E+02
72.0E+01	8.17E+04	7.38E+03	2.630E+02	1.42E+01	3.92E+03	9.89E+02	2.22E+02
73.0E+01	8.30E+04	7.50E+03	2.674E+02	1.42E+01	3.99E+03	1.006E+03	2.22E+02
74.0E+01	8.43E+04	7.62E+03	2.718E+02	1.42E+01	4.06E+03	1.023E+03	2.22E+02
75.0E+01	8.56E+04	7.74E+03	2.762E+02	1.42E+01	4.13E+03	1.040E+03	2.22E+02
76.0E+01	8.69E+04	7.86E+03	2.806E+02	1.42E+01	4.20E+03	1.057E+03	2.22E+02
77.0E+01	8.82E+04	7.98E+03	2.850E+02	1.42E+01	4.27E+03	1.074E+03	2.22E+02
78.0E+01	8.95E+04	8.10E+03	2.894E+02	1.42E+01	4.34E+03	1.091E+03	2.22E+02
79.0E+01	9.08E+04	8.22E+03	2.938E+02	1.42E+01	4.41E+03	1.108E+03	2.22E+02
80.0E+01	9.21E+04	8.34E+03	2.982E+02	1.42E+01	4.48E+03	1.125E+03	2.22E+02
81.0E+01	9.34E+04	8.46E+03	3.026E+02	1.42E+01	4.55E+03	1.142E+03	2.22E+02
82.0E+01	9.47E+04	8.58E+03	3.070E+02	1.42E+01	4.62E+03	1.159E+03	2.22E+02
83.0E+01	9.60E+04	8.70E+03	3.114E+02	1.42E+01	4.69E+03	1.176E+03	2.22E+02
84.0E+01	9.73E+04	8.82E+03	3.158E+02	1.42E+01	4.76E+03	1.193E+03	2.22E+02
85.0E+01	9.86E+04	8.94E+03	3.202E+02	1.42E+01	4.83E+03	1.210E+03	2.22E+02
86.0E+01	1.00E+05	9.06E+03	3.246E+02	1.42E+01	4.90E+03	1.227E+03	2.22E+02
87.0E+01	1.01E+05	9.18E+03	3.290E+02	1.42E+01	4.97E+03	1.244E+03	2.22E+02
88.0E+01	1.02E+05	9.30E+03	3.334E+02	1.42E+01	5.04E+03	1.261E+03	2.22E+02
89.0E+01	1.03E+05	9.42E+03	3.378E+02	1.42E+01	5.11E+03	1.278E+03	2.22E+02
90.0E+01	1.04E+05	9.54E+03	3.422E+02	1.42E+01	5.18E+03	1.295E+03	2.22E+02
91.0E+01	1.05E+05	9.66E+03	3.466E+02	1.42E+01	5.25E+03	1.312E+03	2.22E+02
92.0E+01	1.06E+05	9.78E+03	3.510E+02	1.42E+01	5.32E+03	1.329E+03	2.22E+02
93.0E+01	1.07E+05	9.90E+03	3.554E+02	1.42E+01	5.39E+03	1.346E+03	2.22E+02
94.0E+01	1.08E+05	1.00E+04	3.598E+02	1.42E+01	5.46E+03	1.363E+03	2.22E+02
95.0E+01	1.09E+05	1.01E+04	3.642E+02	1.42E+01	5.53E+03	1.380E+03	2.22E+02
96.0E+01	1.10E+05	1.02E+04	3.686E+02	1.42E+01	5.60E+03	1.397E+03	2.22E+02
97.0E+01	1.11E+05	1.03E+04	3.730E+02	1.42E+01	5.67E+03	1.414E+03	2.22E+02
98.0E+01	1.12E+05	1.04E+04	3.774E+02	1.42E+01	5.74E+03	1.431E+03	2.22E+02
99.0E+01	1.13E+05	1.05E+04	3.818E+02	1.42E+01	5.81E+03	1.448E+03	2.22E+02
100.0E+01	1.14E+05	1.06E+04	3.862E+02	1.42E+01	5.88E+03	1.465E+03	2.22E+02

Table 3c
LEAD
Atomic Collisions

Table 3d
LEAD
Atomic Collisions

E (GeV)	P. (GeV/C)	DF/NX-TOT (MEV/CM/CM ⁻²)	(GM/CM ⁻²)	RANGE		COLLISION (FTI) (CM)	PAIR (ALL) IN PROT IN NEUTR IN GAM IN GMSO	NUCLEAR IN PROT IN NEUTR IN GAM IN GMSO
				DE/JX-PARTIAL (FTI)	DE/JX-PARTIAL (ALL)			
5.80E+03	1.92E+01	7.13E+06	2.74E+05	9.90E+03	1.92E+01	4.73E+01	4.23E+00	4.23E+00
6.00E+03	1.93E+01	3.23E+06	2.84E+05	9.70E+03	1.93E+01	4.56E+01	4.38E+00	4.38E+00
6.20E+03	1.93E+01	3.02E+06	2.93E+05	9.60E+03	1.93E+01	4.52E+01	4.50E+00	4.50E+00
6.40E+03	1.93E+01	3.11E+06	3.02E+05	9.90E+03	1.93E+01	4.68E+01	4.67E+00	4.67E+00
6.60E+03	1.93E+01	3.20E+06	3.10E+05	1.02E+04	1.02E+04	5.02E+01	5.28E+00	5.28E+00
6.80E+03	1.93E+01	3.30E+06	3.18E+05	1.05E+04	1.05E+04	5.20E+01	5.66E+00	5.66E+00
7.00E+03	1.93E+01	3.37E+06	3.29E+05	1.08E+04	1.08E+04	5.32E+01	5.95E+00	5.95E+00
7.20E+03	1.94E+01	3.48E+06	3.38E+05	1.11E+04	1.11E+04	5.42E+01	6.24E+00	6.24E+00
7.40E+03	1.94E+01	3.96E+06	3.65E+05	1.14E+04	1.14E+04	5.68E+01	6.62E+00	6.62E+00
7.60E+03	1.94E+01	4.16E+06	3.75E+05	1.17E+04	1.17E+04	5.84E+01	6.41E+00	6.41E+00
7.80E+03	1.94E+01	4.41E+06	3.86E+05	1.20E+04	1.20E+04	6.00E+01	6.60E+00	6.60E+00
8.00E+03	1.94E+01	4.66E+06	3.97E+05	1.23E+04	1.23E+04	6.16E+01	6.79E+00	6.79E+00
8.20E+03	1.94E+01	4.91E+06	4.08E+05	1.26E+04	1.26E+04	6.32E+01	6.95E+00	6.95E+00
8.40E+03	1.94E+01	5.16E+06	4.19E+05	1.29E+04	1.29E+04	6.48E+01	7.13E+00	7.13E+00
8.60E+03	1.94E+01	5.41E+06	4.30E+05	1.32E+04	1.32E+04	6.64E+01	7.31E+00	7.31E+00
8.80E+03	1.94E+01	5.66E+06	4.41E+05	1.35E+04	1.35E+04	6.80E+01	7.47E+00	7.47E+00
9.00E+03	1.94E+01	5.91E+06	4.52E+05	1.38E+04	1.38E+04	6.97E+01	7.63E+00	7.63E+00
9.20E+03	1.94E+01	6.16E+06	4.63E+05	1.40E+04	1.40E+04	7.13E+01	7.79E+00	7.79E+00
9.40E+03	1.94E+01	6.41E+06	4.74E+05	1.43E+04	1.43E+04	7.29E+01	7.95E+00	7.95E+00
9.60E+03	1.94E+01	6.66E+06	4.85E+05	1.46E+04	1.46E+04	7.45E+01	8.14E+00	8.14E+00
9.80E+03	1.94E+01	6.91E+06	4.96E+05	1.49E+04	1.49E+04	7.61E+01	8.34E+00	8.34E+00
1.00E+04	1.94E+01	7.16E+06	5.07E+05	1.52E+04	1.52E+04	7.76E+01	8.53E+00	8.53E+00
1.02E+04	1.94E+01	7.40E+06	5.18E+05	1.55E+04	1.55E+04	7.91E+01	8.71E+00	8.71E+00
1.04E+04	1.94E+01	7.64E+06	5.29E+05	1.58E+04	1.58E+04	8.07E+01	8.89E+00	8.89E+00
1.06E+04	1.94E+01	7.88E+06	5.40E+05	1.61E+04	1.61E+04	8.23E+01	9.05E+00	9.05E+00
1.08E+04	1.94E+01	8.12E+06	5.52E+05	1.64E+04	1.64E+04	8.39E+01	9.21E+00	9.21E+00
1.10E+04	1.94E+01	8.36E+06	5.64E+05	1.67E+04	1.67E+04	8.55E+01	9.37E+00	9.37E+00
1.12E+04	1.94E+01	8.60E+06	5.75E+05	1.70E+04	1.70E+04	8.71E+01	9.53E+00	9.53E+00
1.14E+04	1.94E+01	8.84E+06	5.86E+05	1.73E+04	1.73E+04	8.87E+01	9.69E+00	9.69E+00
1.16E+04	1.94E+01	9.08E+06	5.97E+05	1.76E+04	1.76E+04	9.03E+01	9.85E+00	9.85E+00
1.18E+04	1.94E+01	9.32E+06	6.08E+05	1.79E+04	1.79E+04	9.19E+01	9.97E+00	9.97E+00
1.20E+04	1.94E+01	9.56E+06	6.19E+05	1.82E+04	1.82E+04	9.35E+01	1.01E+01	1.01E+01
1.22E+04	1.94E+01	9.80E+06	6.30E+05	1.85E+04	1.85E+04	9.51E+01	1.02E+01	1.02E+01
1.24E+04	1.94E+01	1.00E+07	6.41E+05	1.88E+04	1.88E+04	9.67E+01	1.03E+01	1.03E+01
1.26E+04	1.94E+01	1.02E+07	6.52E+05	1.91E+04	1.91E+04	9.83E+01	1.04E+01	1.04E+01
1.28E+04	1.94E+01	1.04E+07	6.63E+05	1.94E+04	1.94E+04	9.99E+01	1.05E+01	1.05E+01
1.30E+04	1.94E+01	1.06E+07	6.74E+05	1.97E+04	1.97E+04	1.015E+02	1.06E+01	1.06E+01
1.32E+04	1.94E+01	1.08E+07	6.85E+05	2.00E+04	2.00E+04	1.031E+02	1.07E+01	1.07E+01
1.34E+04	1.94E+01	1.10E+07	6.96E+05	2.03E+04	2.03E+04	1.047E+02	1.08E+01	1.08E+01
1.36E+04	1.94E+01	1.12E+07	7.07E+05	2.06E+04	2.06E+04	1.063E+02	1.09E+01	1.09E+01
1.38E+04	1.94E+01	1.14E+07	7.18E+05	2.09E+04	2.09E+04	1.079E+02	1.10E+01	1.10E+01
1.40E+04	1.94E+01	1.16E+07	7.29E+05	2.12E+04	2.12E+04	1.095E+02	1.11E+01	1.11E+01
1.42E+04	1.94E+01	1.18E+07	7.40E+05	2.15E+04	2.15E+04	1.111E+02	1.12E+01	1.12E+01
1.44E+04	1.94E+01	1.20E+07	7.51E+05	2.18E+04	2.18E+04	1.127E+02	1.13E+01	1.13E+01
1.46E+04	1.94E+01	1.22E+07	7.62E+05	2.21E+04	2.21E+04	1.143E+02	1.14E+01	1.14E+01
1.48E+04	1.94E+01	1.24E+07	7.73E+05	2.24E+04	2.24E+04	1.159E+02	1.15E+01	1.15E+01
1.50E+04	1.94E+01	1.26E+07	7.84E+05	2.27E+04	2.27E+04	1.175E+02	1.16E+01	1.16E+01
1.52E+04	1.94E+01	1.28E+07	7.95E+05	2.30E+04	2.30E+04	1.191E+02	1.17E+01	1.17E+01
1.54E+04	1.94E+01	1.30E+07	8.06E+05	2.33E+04	2.33E+04	1.207E+02	1.18E+01	1.18E+01
1.56E+04	1.94E+01	1.32E+07	8.17E+05	2.36E+04	2.36E+04	1.223E+02	1.19E+01	1.19E+01
1.58E+04	1.94E+01	1.34E+07	8.28E+05	2.39E+04	2.39E+04	1.239E+02	1.20E+01	1.20E+01
1.60E+04	1.94E+01	1.36E+07	8.39E+05	2.42E+04	2.42E+04	1.255E+02	1.21E+01	1.21E+01
1.62E+04	1.94E+01	1.38E+07	8.50E+05	2.45E+04	2.45E+04	1.271E+02	1.22E+01	1.22E+01
1.64E+04	1.94E+01	1.40E+07	8.61E+05	2.48E+04	2.48E+04	1.287E+02	1.23E+01	1.23E+01
1.66E+04	1.94E+01	1.42E+07	8.72E+05	2.51E+04	2.51E+04	1.303E+02	1.24E+01	1.24E+01
1.68E+04	1.94E+01	1.44E+07	8.83E+05	2.54E+04	2.54E+04	1.319E+02	1.25E+01	1.25E+01
1.70E+04	1.94E+01	1.46E+07	8.94E+05	2.57E+04	2.57E+04	1.335E+02	1.26E+01	1.26E+01
1.72E+04	1.94E+01	1.48E+07	9.05E+05	2.60E+04	2.60E+04	1.351E+02	1.27E+01	1.27E+01
1.74E+04	1.94E+01	1.50E+07	9.16E+05	2.63E+04	2.63E+04	1.367E+02	1.28E+01	1.28E+01
1.76E+04	1.94E+01	1.52E+07	9.27E+05	2.66E+04	2.66E+04	1.383E+02	1.29E+01	1.29E+01
1.78E+04	1.94E+01	1.54E+07	9.38E+05	2.69E+04	2.69E+04	1.400E+02	1.30E+01	1.30E+01
1.80E+04	1.94E+01	1.56E+07	9.49E+05	2.72E+04	2.72E+04	1.416E+02	1.31E+01	1.31E+01
1.82E+04	1.94E+01	1.58E+07	9.60E+05	2.75E+04	2.75E+04	1.432E+02	1.32E+01	1.32E+01
1.84E+04	1.94E+01	1.60E+07	9.71E+05	2.78E+04	2.78E+04	1.448E+02	1.33E+01	1.33E+01
1.86E+04	1.94E+01	1.62E+07	9.82E+05	2.81E+04	2.81E+04	1.464E+02	1.34E+01	1.34E+01
1.88E+04	1.94E+01	1.64E+07	9.93E+05	2.84E+04	2.84E+04	1.480E+02	1.35E+01	1.35E+01
1.90E+04	1.94E+01	1.66E+07	1.004E+06	2.87E+04	2.87E+04	1.496E+02	1.36E+01	1.36E+01
1.92E+04	1.94E+01	1.68E+07	1.015E+06	2.90E+04	2.90E+04	1.512E+02	1.37E+01	1.37E+01
1.94E+04	1.94E+01	1.70E+07	1.026E+06	2.93E+04	2.93E+04	1.528E+02	1.38E+01	1.38E+01
1.96E+04	1.94E+01	1.72E+07	1.037E+06	2.96E+04	2.96E+04	1.544E+02	1.39E+01	1.39E+01
1.98E+04	1.94E+01	1.74E+07	1.048E+06	2.99E+04	2.99E+04	1.560E+02	1.40E+01	1.40E+01
2.00E+04	1.94E+01	1.76E+07	1.059E+06	3.02E+04	3.02E+04	1.576E+02	1.41E+01	1.41E+01
2.02E+04	1.94E+01	1.78E+07	1.070E+06	3.05E+04	3.05E+04	1.592E+02	1.42E+01	1.42E+01
2.04E+04	1.94E+01	1.80E+07	1.081E+06	3.08E+04	3.08E+04	1.608E+02	1.43E+01	1.43E+01
2.06E+04	1.94E+01	1.82E+07	1.092E+06	3.11E+04	3.11E+04	1.624E+02	1.44E+01	1.44E+01
2.08E+04	1.94E+01	1.84E+07	1.103E+06	3.14E+04	3.14E+04	1.640E+02	1.45E+01	1.45E+01
2.10E+04	1.94E+01	1.86E+07	1.114E+06	3.17E+04	3.17E+04	1.656E+02	1.46E+01	1.46E+01
2.12E+04	1.94E+01	1.88E+07	1.125E+06	3.20E+04	3.20E+04	1.672E+02	1.47E+01	1.47E+01
2.14E+04	1.94E+01	1.90E+07	1.136E+06	3.23E+04	3.23E+04	1.688E+02	1.48E+01	1.48E+01
2.16E+04	1.94E+01	1.92E+07	1.147E+06	3.26E+04	3.26E+04	1.704E+02	1.49E+01	1.49E+01
2.18E+04	1.94E+01	1.94E+07	1.158E+06	3.29E+04	3.29E+04	1.720E+02	1.50E+01	1.50E+01
2.20E+04	1.94E+01	1.96E+07	1.169E+06	3.32E+04	3.32E+04	1.736E+02	1.51E+01	1.51E+01
2.22E+04	1.94E+01	1.98E+07	1.180E+06	3.35E+04	3.35E+04	1.752E+02	1.52E+01	1.52E+01
2.24E+04	1.94E+01	2.00E+07	1.191E+06	3.38E+04	3.38E+04	1.768E+02	1.53E+01	1.53E+01
2.26E+04	1.94E+01	2.02E+07	1.202E+06	3.41E+04	3.41E+04	1.784E+02	1.54E+01	1.54E+01

Table 4a
URANIUM
Atomic Collisions

MUON DE/DX AND RANGE TABLES

$\chi_0 = 0$	$\cdot 1612579F+00$	$CHSQ/GM$	$DE/DX-TOT$	$DE/DX-PARTIAL$	$DE/DX-PAIR$	$DE/DX-PRON$	$DE/DX-NUCLEAR$
(GFV)	(MEV/C)	(GM/CHSQ)	(GM/CHSQ)	(GM/CHSQ)	(GM/CHSQ)	(GM/CHSQ)	(GM/CHSQ)
100E-01	374F+01	164E+01	862E-01	283E-02	374E+01	770E-05	
1200E-01	736F+01	154E+01	236E-02	177E-02	236E+01	146E-04	
1400E-01	186F+01	154E+01	186E+01	177E-01	186E+01	219E-04	
1600E-01	146F+01	154E+01	146E+01	177E-01	146E+01	219E-04	
1800E-01	129E+01	154E+01	129E+01	177E-01	129E+01	219E-04	
2000E-01	102E+01	154E+01	102E+01	177E-01	102E+01	219E-04	
2200E-01	76E+01	154E+01	76E+01	177E-01	76E+01	219E-04	
2400E-01	51E+01	154E+01	51E+01	177E-01	51E+01	219E-04	
2600E-01	31E+01	154E+01	31E+01	177E-01	31E+01	219E-04	
2800E-01	19E+01	154E+01	19E+01	177E-01	19E+01	219E-04	
3000E-01	10E+01	154E+01	10E+01	177E-01	10E+01	219E-04	
3200E-01	5E+01	154E+01	5E+01	177E-01	5E+01	219E-04	
3400E-01	2E+01	154E+01	2E+01	177E-01	2E+01	219E-04	
3600E-01	1E+01	154E+01	1E+01	177E-01	1E+01	219E-04	
3800E-01	5E-01	154E+01	5E-01	177E-01	5E-01	219E-04	
4000E-01	2E-01	154E+01	2E-01	177E-01	2E-01	219E-04	
4200E-01	1E-01	154E+01	1E-01	177E-01	1E-01	219E-04	
4400E-01	5E-02	154E+01	5E-02	177E-01	5E-02	219E-04	
4600E-01	2E-02	154E+01	2E-02	177E-01	2E-02	219E-04	
4800E-01	1E-02	154E+01	1E-02	177E-01	1E-02	219E-04	
5000E-01	5E-03	154E+01	5E-03	177E-01	5E-03	219E-04	
5200E-01	2E-03	154E+01	2E-03	177E-01	2E-03	219E-04	
5400E-01	1E-03	154E+01	1E-03	177E-01	1E-03	219E-04	
5600E-01	5E-04	154E+01	5E-04	177E-01	5E-04	219E-04	
5800E-01	2E-04	154E+01	2E-04	177E-01	2E-04	219E-04	
6000E-01	1E-04	154E+01	1E-04	177E-01	1E-04	219E-04	
6200E-01	5E-05	154E+01	5E-05	177E-01	5E-05	219E-04	
6400E-01	2E-05	154E+01	2E-05	177E-01	2E-05	219E-04	
6600E-01	1E-05	154E+01	1E-05	177E-01	1E-05	219E-04	
6800E-01	5E-06	154E+01	5E-06	177E-01	5E-06	219E-04	
7000E-01	2E-06	154E+01	2E-06	177E-01	2E-06	219E-04	
7200E-01	1E-06	154E+01	1E-06	177E-01	1E-06	219E-04	
7400E-01	5E-07	154E+01	5E-07	177E-01	5E-07	219E-04	
7600E-01	2E-07	154E+01	2E-07	177E-01	2E-07	219E-04	
7800E-01	1E-07	154E+01	1E-07	177E-01	1E-07	219E-04	
8000E-01	5E-08	154E+01	5E-08	177E-01	5E-08	219E-04	
8200E-01	2E-08	154E+01	2E-08	177E-01	2E-08	219E-04	
8400E-01	1E-08	154E+01	1E-08	177E-01	1E-08	219E-04	
8600E-01	5E-09	154E+01	5E-09	177E-01	5E-09	219E-04	
8800E-01	2E-09	154E+01	2E-09	177E-01	2E-09	219E-04	
9000E-01	1E-09	154E+01	1E-09	177E-01	1E-09	219E-04	
9200E-01	5E-10	154E+01	5E-10	177E-01	5E-10	219E-04	
9400E-01	2E-10	154E+01	2E-10	177E-01	2E-10	219E-04	
9600E-01	1E-10	154E+01	1E-10	177E-01	1E-10	219E-04	
9800E-01	5E-11	154E+01	5E-11	177E-01	5E-11	219E-04	
10000E-01	2E-11	154E+01	2E-11	177E-01	2E-11	219E-04	
10200E-01	1E-11	154E+01	1E-11	177E-01	1E-11	219E-04	
10400E-01	5E-12	154E+01	5E-12	177E-01	5E-12	219E-04	
10600E-01	2E-12	154E+01	2E-12	177E-01	2E-12	219E-04	
10800E-01	1E-12	154E+01	1E-12	177E-01	1E-12	219E-04	
11000E-01	5E-13	154E+01	5E-13	177E-01	5E-13	219E-04	
11200E-01	2E-13	154E+01	2E-13	177E-01	2E-13	219E-04	
11400E-01	1E-13	154E+01	1E-13	177E-01	1E-13	219E-04	
11600E-01	5E-14	154E+01	5E-14	177E-01	5E-14	219E-04	
11800E-01	2E-14	154E+01	2E-14	177E-01	2E-14	219E-04	
12000E-01	1E-14	154E+01	1E-14	177E-01	1E-14	219E-04	
12200E-01	5E-15	154E+01	5E-15	177E-01	5E-15	219E-04	
12400E-01	2E-15	154E+01	2E-15	177E-01	2E-15	219E-04	
12600E-01	1E-15	154E+01	1E-15	177E-01	1E-15	219E-04	
12800E-01	5E-16	154E+01	5E-16	177E-01	5E-16	219E-04	
13000E-01	2E-16	154E+01	2E-16	177E-01	2E-16	219E-04	
13200E-01	1E-16	154E+01	1E-16	177E-01	1E-16	219E-04	
13400E-01	5E-17	154E+01	5E-17	177E-01	5E-17	219E-04	
13600E-01	2E-17	154E+01	2E-17	177E-01	2E-17	219E-04	
13800E-01	1E-17	154E+01	1E-17	177E-01	1E-17	219E-04	
14000E-01	5E-18	154E+01	5E-18	177E-01	5E-18	219E-04	
14200E-01	2E-18	154E+01	2E-18	177E-01	2E-18	219E-04	
14400E-01	1E-18	154E+01	1E-18	177E-01	1E-18	219E-04	
14600E-01	5E-19	154E+01	5E-19	177E-01	5E-19	219E-04	
14800E-01	2E-19	154E+01	2E-19	177E-01	2E-19	219E-04	
15000E-01	1E-19	154E+01	1E-19	177E-01	1E-19	219E-04	
15200E-01	5E-20	154E+01	5E-20	177E-01	5E-20	219E-04	
15400E-01	2E-20	154E+01	2E-20	177E-01	2E-20	219E-04	
15600E-01	1E-20	154E+01	1E-20	177E-01	1E-20	219E-04	
15800E-01	5E-21	154E+01	5E-21	177E-01	5E-21	219E-04	
16000E-01	2E-21	154E+01	2E-21	177E-01	2E-21	219E-04	
16200E-01	1E-21	154E+01	1E-21	177E-01	1E-21	219E-04	
16400E-01	5E-22	154E+01	5E-22	177E-01	5E-22	219E-04	
16600E-01	2E-22	154E+01	2E-22	177E-01	2E-22	219E-04	
16800E-01	1E-22	154E+01	1E-22	177E-01	1E-22	219E-04	
17000E-01	5E-23	154E+01	5E-23	177E-01	5E-23	219E-04	
17200E-01	2E-23	154E+01	2E-23	177E-01	2E-23	219E-04	
17400E-01	1E-23	154E+01	1E-23	177E-01	1E-23	219E-04	
17600E-01	5E-24	154E+01	5E-24	177E-01	5E-24	219E-04	
17800E-01	2E-24	154E+01	2E-24	177E-01	2E-24	219E-04	
18000E-01	1E-24	154E+01	1E-24	177E-01	1E-24	219E-04	
18200E-01	5E-25	154E+01	5E-25	177E-01	5E-25	219E-04	
18400E-01	2E-25	154E+01	2E-25	177E-01	2E-25	219E-04	
18600E-01	1E-25	154E+01	1E-25	177E-01	1E-25	219E-04	
18800E-01	5E-26	154E+01	5E-26	177E-01	5E-26	219E-04	
19000E-01	2E-26	154E+01	2E-26	177E-01	2E-26	219E-04	
19200E-01	1E-26	154E+01	1E-26	177E-01	1E-26	219E-04	
19400E-01	5E-27	154E+01	5E-27	177E-01	5E-27	219E-04	
19600E-01	2E-27	154E+01	2E-27	177E-01	2E-27	219E-04	
19800E-01	1E-27	154E+01	1E-27	177E-01	1E-27	219E-04	
20000E-01	5E-28	154E+01	5E-28	177E-01	5E-28	219E-04	
20200E-01	2E-28	154E+01	2E-28	177E-01	2E-28	219E-04	
20400E-01	1E-28	154E+01	1E-28	177E-01	1E-28	219E-04	
20600E-01	5E-29	154E+01	5E-29	177E-01	5E-29	219E-04	
20800E-01	2E-29	154E+01	2E-29	177E-01	2E-29	219E-04	
21000E-01	1E-29	154E+01	1E-29	177E-01	1E-29	219E-04	
21200E-01	5E-30	154E+01	5E-30	177E-01	5E-30	219E-04	
21400E-01	2E-30	154E+01	2E-30	177E-01	2E-30	219E-04	
21600E-01	1E-30	154E+01	1E-30	177E-01	1E-30	219E-04	
21800E-01	5E-31	154E+01	5E-31	177E-01	5E-31	219E-04	
22000E-01	2E-31	154E+01	2E-31	177E-01	2E-31	219E-04	
22200E-01	1E-31	154E+01	1E-31	177E-01	1E-31	219E-04	
22400E-01	5E-32	154E+01	5E-32	177E-01	5E-32	219E-04	
22600E-01	2E-32	154E+01	2E-32	177E-01	2E-32	219E-04	
22800E-01	1E-32	154E+01	1E-32	177E-01	1E-32	219E-04	
23000E-01	5E-33	154E+01	5E-33	177E-01	5E-33	219E-04	
23200E-01	2E-33	154E+01	2E-33	177E-01	2E-33	219E-04	
23400E-01	1E-33	154E+01	1E-33	177E-01	1E-33	219E-04	
23600E-01	5E-34	154E+01	5E-34	177E-01	5E-34	219E-04	
23800E-01	2E-34	154E+01	2E-34	177E-01	2E-34	219E-04	
24000E-01	1E-34	154E+01	1E-34	177E-01	1E-34	219E-04	
24200E-01	5E-35	154E+01	5E-35	177E-01	5E-35	219E-04	
24400E-01	2E-35	154E+01	2E-35	177E-01	2E-35	219E-04	
24600E-01	1E-35	154E+01	1E-35	177E-01	1E-35	219E-04	
24800E-01	5E-36	154E+01	5E-36	177E-01	5E-36	219E-04	

URANIUM Atomic Collisions

Table 4c

URANIUM

Atomic Collisions

E (GeV)	P (GeV/c)	DE/DX-TOT (MeV/GM/CM50)	RANGE (GM/CM50)	COLLISION (FTI)	PAIR PROD (ALL TN MEV/GM/CM50)	DE/DX-PARTIAL PREMSTRAL	NUCLEAR
.900F+02	.901F+02	.173F+01	.547F+05	.287E+04	.941F+02	.173E+01	.655F+00
.950F+02	.951F+02	.174F+01	.576F+05	.302E+04	.991F+02	.174F+01	.694F+00
.100F+03	.100E+03	.174F+01	.605F+05	.317E+04	.104E+03	.174F+01	.734F+00
.105F+03	.105E+03	.174F+01	.633F+05	.332E+04	.109F+03	.174F+01	.774F+00
.110F+03	.110E+03	.175F+01	.662F+05	.347E+04	.114E+03	.175E+01	.814F+00
.115F+03	.115E+03	.175F+01	.691F+05	.362E+04	.119E+03	.175F+01	.855F+00
.120F+03	.120E+03	.175F+01	.719F+05	.377E+04	.124E+03	.175F+01	.895F+00
.125F+03	.125E+03	.176F+01	.748F+05	.392E+04	.129E+03	.176E+01	.935F+00
.130F+03	.130E+03	.176F+01	.776F+05	.407E+04	.134E+03	.176E+01	.976F+00
.135F+03	.135E+03	.176F+01	.805F+05	.422E+04	.138E+03	.176F+01	.102E+01
.140F+03	.140E+03	.176F+01	.833F+05	.437E+04	.143F+03	.176F+01	.106F+01
.145F+03	.145E+03	.177F+01	.861F+05	.452E+04	.148F+03	.177F+01	.110F+01
.150F+03	.150E+03	.177F+01	.890F+05	.466E+04	.153E+03	.177F+01	.114E+01
.155F+03	.155E+03	.177F+01	.918F+05	.481F+04	.158E+03	.177F+01	.118E+01
.160F+03	.160E+03	.177F+01	.946F+05	.496F+04	.163E+03	.177F+01	.122E+01
.165F+03	.165E+03	.177F+01	.974F+05	.511E+04	.168E+03	.177F+01	.126E+01
.170F+03	.170E+03	.178F+01	.100E+06	.526E+04	.172F+03	.178F+01	.130E+01
.175F+03	.175E+03	.178F+01	.103E+06	.540F+04	.177F+03	.178F+01	.134F+01
.180F+03	.180E+03	.178F+01	.106E+06	.555E+04	.182F+03	.178F+01	.138F+01
.185F+03	.185E+03	.178F+01	.109E+06	.570F+04	.187F+03	.178F+01	.143F+01
.190F+03	.190E+03	.178F+01	.111E+06	.585F+04	.192F+03	.178F+01	.147F+01
.195F+03	.195E+03	.178F+01	.114E+06	.599F+04	.197F+03	.178F+01	.151E+01
.200F+03	.200E+03	.179F+01	.117E+06	.614F+04	.201F+03	.179F+01	.155E+01
.210F+03	.210E+03	.179F+01	.123E+06	.643F+04	.211F+03	.179E+01	.163E+01
.220F+03	.220E+03	.179F+01	.124E+06	.673F+04	.221F+03	.179E+01	.172E+01
.230F+03	.230E+03	.179F+01	.134E+06	.702F+04	.230F+03	.179E+01	.180E+01
.240F+03	.240E+03	.180F+01	.139E+06	.731F+04	.240E+03	.180E+01	.188E+01
.250F+03	.250E+03	.180F+01	.145E+06	.760F+04	.249F+03	.180E+01	.197E+01
.260F+03	.260E+03	.180F+01	.151E+06	.789F+04	.259F+03	.180E+01	.205E+01
.270F+03	.270E+03	.180F+01	.156E+06	.818F+04	.269F+03	.180E+01	.213E+01
.280F+03	.280E+03	.181F+01	.162E+06	.847F+04	.278F+03	.181E+01	.222E+01
.290F+03	.290E+03	.181F+01	.167E+06	.876F+04	.288F+03	.181E+01	.230E+01
.300F+03	.310E+03	.181F+01	.173E+06	.905E+04	.297E+03	.181E+01	.239E+01
.310E+03	.310E+03	.181F+01	.178F+06	.934F+04	.307E+03	.181E+01	.247E+01
.320F+03	.320E+03	.181F+01	.184E+06	.963F+04	.316F+03	.181E+01	.255E+01
.330F+03	.330E+03	.182F+01	.189E+06	.992F+04	.326F+03	.182E+01	.262E+01
.340F+03	.340E+03	.182F+01	.195E+06	.102F+05	.337E+03	.182E+01	.270E+01
.350F+03	.350E+03	.182F+01	.200E+06	.105E+05	.344E+03	.182E+01	.278E+01
.360F+03	.360E+03	.182F+01	.206E+06	.108E+05	.354E+03	.182E+01	.289E+01
.370F+03	.370E+03	.182F+01	.211E+06	.111E+05	.363E+03	.182E+01	.298E+01
.380F+03	.380E+03	.183E+01	.217E+06	.114E+05	.373E+03	.183E+01	.306E+01
.390F+03	.390E+03	.183E+01	.222E+06	.116E+05	.382E+03	.183E+01	.315E+01
.400E+03	.400E+03	.183F+01	.228E+06	.119F+05	.392E+03	.183F+01	.323E+01
.410F+03	.410E+03	.183F+01	.237E+06	.122E+05	.401E+03	.183E+01	.332E+01
.420E+03	.420E+03	.183F+01	.239E+06	.125E+05	.410E+03	.183E+01	.340E+01
.430E+03	.430E+03	.183E+01	.244E+06	.128E+05	.426E+03	.183E+01	.349E+01
.440E+03	.440E+03	.183E+01	.249E+06	.131E+05	.435E+03	.183E+01	.357E+01
.450F+03	.450E+03	.184E+01	.255E+06	.134E+05	.439E+03	.184E+01	.366E+01
.460F+03	.460E+03	.184E+01	.260E+06	.137E+05	.448E+03	.184E+01	.375E+01
.470E+03	.470E+03	.184E+01	.266E+06	.139E+05	.457E+03	.184E+01	.383E+01
.480E+03	.480E+03	.184E+01	.271E+06	.142E+05	.467E+03	.184E+01	.392E+01
.490E+03	.490E+03	.184E+01	.277E+06	.145E+05	.476E+03	.184E+01	.400E+01
.500E+03	.500E+03	.184E+01	.282E+06	.148E+05	.485E+03	.184E+01	.409E+01
.520E+03	.520E+03	.184E+01	.293E+06	.154E+05	.504E+03	.184E+01	.426E+01
.540E+03	.540E+03	.185E+01	.304E+06	.159E+05	.523E+03	.185E+01	.443E+01
.560E+03	.560E+03	.185F+01	.315E+06	.165F+05	.541E+03	.185E+01	.461E+01

Table 4d
URANIUM
Atomic Collision

P. E.	DE/D _X -TOT		COLLISION (ALL)		DE/D _X -PARTIAL	
	(GeV/c)	(GeV/c/CMOS)	(cm)	(cm)	(cm)	(cm)
F.	5.00E+03	1.85E+01	1.71E+05	1.95E+01	4.78E+01	4.73E+00
	6.00E+03	1.85E+01	1.76E+05	1.85E+01	4.95E+01	4.86E+00
	6.67E+03	1.85E+01	1.82E+05	1.86E+01	5.13E+01	5.00E+00
	7.00E+03	1.85E+01	1.87E+05	1.86E+01	5.30E+01	5.17E+00
	7.50E+03	1.85E+01	1.93E+05	1.86E+01	5.47E+01	5.34E+00
	8.00E+03	1.85E+01	1.99E+05	1.86E+01	5.64E+01	5.51E+00
	8.50E+03	1.85E+01	2.05E+05	1.86E+01	5.82E+01	5.68E+00
	9.00E+03	1.85E+01	2.11E+05	1.86E+01	6.00E+01	5.85E+00
	9.50E+03	1.85E+01	2.17E+05	1.86E+01	6.17E+01	6.02E+00
	1.00E+04	1.85E+01	2.23E+05	1.86E+01	6.34E+01	6.19E+00
	1.05E+04	1.85E+01	2.29E+05	1.86E+01	6.51E+01	6.36E+00
	1.10E+04	1.85E+01	2.35E+05	1.86E+01	6.67E+01	6.53E+00
	1.15E+04	1.85E+01	2.41E+05	1.86E+01	6.84E+01	6.70E+00
	1.20E+04	1.85E+01	2.47E+05	1.86E+01	7.01E+01	6.87E+00
	1.25E+04	1.85E+01	2.53E+05	1.86E+01	7.18E+01	7.04E+00
	1.30E+04	1.85E+01	2.59E+05	1.86E+01	7.35E+01	7.21E+00
	1.35E+04	1.85E+01	2.65E+05	1.86E+01	7.52E+01	7.38E+00
	1.40E+04	1.85E+01	2.71E+05	1.86E+01	7.69E+01	7.55E+00
	1.45E+04	1.85E+01	2.77E+05	1.86E+01	7.86E+01	7.72E+00
	1.50E+04	1.85E+01	2.83E+05	1.86E+01	8.03E+01	7.89E+00
	1.55E+04	1.85E+01	2.89E+05	1.86E+01	8.20E+01	8.06E+00
	1.60E+04	1.85E+01	2.95E+05	1.86E+01	8.37E+01	8.23E+00
	1.65E+04	1.85E+01	3.01E+05	1.86E+01	8.54E+01	8.40E+00
	1.70E+04	1.85E+01	3.07E+05	1.86E+01	8.71E+01	8.57E+00
	1.75E+04	1.85E+01	3.13E+05	1.86E+01	8.88E+01	8.74E+00
	1.80E+04	1.85E+01	3.19E+05	1.86E+01	9.05E+01	8.91E+00
	1.85E+04	1.85E+01	3.25E+05	1.86E+01	9.22E+01	9.08E+00
	1.90E+04	1.85E+01	3.31E+05	1.86E+01	9.39E+01	9.25E+00
	1.95E+04	1.85E+01	3.37E+05	1.86E+01	9.56E+01	9.42E+00
	2.00E+04	1.85E+01	3.43E+05	1.86E+01	9.73E+01	9.59E+00
	2.05E+04	1.85E+01	3.49E+05	1.86E+01	9.90E+01	9.76E+00
	2.10E+04	1.85E+01	3.55E+05	1.86E+01	1.007E+02	9.93E+00
	2.15E+04	1.85E+01	3.61E+05	1.86E+01	1.024E+02	1.010E+01
	2.20E+04	1.85E+01	3.67E+05	1.86E+01	1.041E+02	1.017E+01
	2.25E+04	1.85E+01	3.73E+05	1.86E+01	1.058E+02	1.024E+01
	2.30E+04	1.85E+01	3.79E+05	1.86E+01	1.075E+02	1.031E+01
	2.35E+04	1.85E+01	3.85E+05	1.86E+01	1.092E+02	1.038E+01
	2.40E+04	1.85E+01	3.91E+05	1.86E+01	1.109E+02	1.045E+01
	2.45E+04	1.85E+01	3.97E+05	1.86E+01	1.126E+02	1.052E+01
	2.50E+04	1.85E+01	4.03E+05	1.86E+01	1.143E+02	1.059E+01
	2.55E+04	1.85E+01	4.09E+05	1.86E+01	1.160E+02	1.066E+01
	2.60E+04	1.85E+01	4.15E+05	1.86E+01	1.177E+02	1.073E+01
	2.65E+04	1.85E+01	4.21E+05	1.86E+01	1.194E+02	1.080E+01
	2.70E+04	1.85E+01	4.27E+05	1.86E+01	1.211E+02	1.087E+01
	2.75E+04	1.85E+01	4.33E+05	1.86E+01	1.228E+02	1.094E+01
	2.80E+04	1.85E+01	4.39E+05	1.86E+01	1.245E+02	1.101E+01
	2.85E+04	1.85E+01	4.45E+05	1.86E+01	1.262E+02	1.108E+01
	2.90E+04	1.85E+01	4.51E+05	1.86E+01	1.279E+02	1.115E+01
	2.95E+04	1.85E+01	4.57E+05	1.86E+01	1.296E+02	1.122E+01
	3.00E+04	1.85E+01	4.63E+05	1.86E+01	1.313E+02	1.129E+01
	3.05E+04	1.85E+01	4.69E+05	1.86E+01	1.330E+02	1.136E+01
	3.10E+04	1.85E+01	4.75E+05	1.86E+01	1.347E+02	1.143E+01
	3.15E+04	1.85E+01	4.81E+05	1.86E+01	1.364E+02	1.150E+01
	3.20E+04	1.85E+01	4.87E+05	1.86E+01	1.381E+02	1.157E+01
	3.25E+04	1.85E+01	4.93E+05	1.86E+01	1.398E+02	1.164E+01
	3.30E+04	1.85E+01	5.00E+05	1.86E+01	1.415E+02	1.171E+01
	3.35E+04	1.85E+01	5.06E+05	1.86E+01	1.432E+02	1.178E+01
	3.40E+04	1.85E+01	5.12E+05	1.86E+01	1.449E+02	1.185E+01
	3.45E+04	1.85E+01	5.18E+05	1.86E+01	1.466E+02	1.192E+01
	3.50E+04	1.85E+01	5.24E+05	1.86E+01	1.483E+02	1.199E+01
	3.55E+04	1.85E+01	5.30E+05	1.86E+01	1.500E+02	1.206E+01
	3.60E+04	1.85E+01	5.36E+05	1.86E+01	1.517E+02	1.213E+01
	3.65E+04	1.85E+01	5.42E+05	1.86E+01	1.534E+02	1.220E+01
	3.70E+04	1.85E+01	5.48E+05	1.86E+01	1.551E+02	1.227E+01
	3.75E+04	1.85E+01	5.54E+05	1.86E+01	1.568E+02	1.234E+01
	3.80E+04	1.85E+01	5.60E+05	1.86E+01	1.585E+02	1.241E+01
	3.85E+04	1.85E+01	5.66E+05	1.86E+01	1.602E+02	1.248E+01
	3.90E+04	1.85E+01	5.72E+05	1.86E+01	1.619E+02	1.255E+01
	3.95E+04	1.85E+01	5.78E+05	1.86E+01	1.636E+02	1.262E+01
	4.00E+04	1.85E+01	5.84E+05	1.86E+01	1.653E+02	1.269E+01
	4.05E+04	1.85E+01	5.90E+05	1.86E+01	1.670E+02	1.276E+01
	4.10E+04	1.85E+01	5.96E+05	1.86E+01	1.687E+02	1.283E+01
	4.15E+04	1.85E+01	6.02E+05	1.86E+01	1.704E+02	1.290E+01
	4.20E+04	1.85E+01	6.08E+05	1.86E+01	1.721E+02	1.297E+01
	4.25E+04	1.85E+01	6.14E+05	1.86E+01	1.738E+02	1.304E+01
	4.30E+04	1.85E+01	6.20E+05	1.86E+01	1.755E+02	1.311E+01
	4.35E+04	1.85E+01	6.26E+05	1.86E+01	1.772E+02	1.318E+01
	4.40E+04	1.85E+01	6.32E+05	1.86E+01	1.789E+02	1.325E+01
	4.45E+04	1.85E+01	6.38E+05	1.86E+01	1.806E+02	1.332E+01
	4.50E+04	1.85E+01	6.44E+05	1.86E+01	1.823E+02	1.339E+01
	4.55E+04	1.85E+01	6.50E+05	1.86E+01	1.840E+02	1.346E+01
	4.60E+04	1.85E+01	6.56E+05	1.86E+01	1.857E+02	1.353E+01
	4.65E+04	1.85E+01	6.62E+05	1.86E+01	1.874E+02	1.360E+01
	4.70E+04	1.85E+01	6.68E+05	1.86E+01	1.891E+02	1.367E+01
	4.75E+04	1.85E+01	6.74E+05	1.86E+01	1.908E+02	1.374E+01
	4.80E+04	1.85E+01	6.80E+05	1.86E+01	1.925E+02	1.381E+01
	4.85E+04	1.85E+01	6.86E+05	1.86E+01	1.942E+02	1.388E+01
	4.90E+04	1.85E+01	6.92E+05	1.86E+01	1.959E+02	1.395E+01
	4.95E+04	1.85E+01	6.98E+05	1.86E+01	1.976E+02	1.402E+01
	5.00E+04	1.85E+01	7.04E+05	1.86E+01	1.993E+02	1.409E+01
	5.05E+04	1.85E+01	7.10E+05	1.86E+01	2.010E+02	1.416E+01
	5.10E+04	1.85E+01	7.16E+05	1.86E+01	2.027E+02	1.423E+01
	5.15E+04	1.85E+01	7.22E+05	1.86E+01	2.044E+02	1.430E+01
	5.20E+04	1.85E+01	7.28E+05	1.86E+01	2.061E+02	1.437E+01
	5.25E+04	1.85E+01	7.34E+05	1.86E+01	2.078E+02	1.444E+01
	5.30E+04	1.85E+01	7.40E+05	1.86E+01	2.095E+02	1.451E+01
	5.35E+04	1.85E+01	7.46E+05	1.86E+01	2.112E+02	1.458E+01
	5.40E+04	1.85E+01	7.52E+05	1.86E+01	2.129E+02	1.465E+01
	5.45E+04	1.85E+01	7.58E+05	1.86E+01	2.146E+02	1.472E+01
	5.50E+04	1.85E+01	7.64E+05	1.86E+01	2.163E+02	1.479E+01
	5.55E+04	1.85E+01	7.70E+05	1.86E+01	2.180E+02	1.486E+01
	5.60E+04	1.85E+01	7.76E+05	1.86E+01	2.197E+02	1.493E+01
	5.65E+04	1.85E+01	7.82E+05	1.86E+01	2.214E+02	1.500E+01
	5.70E+04	1.85E+01	7.88E+05	1.86E+01	2.231E+02	1.507E+01
	5.75E+04	1.85E+01	7.94E+05	1.86E+01	2.248E+02	1.514E+01
	5.80E+04	1.85E+01	8.00E+05	1.86E+01	2.265E+02	1.521E+01
	5.85E+04	1.85E+01	8.06E+05	1.86E+01	2.282E+02	1.528E+01
	5.90E+04	1.85E+01	8.12E+05	1.86E+01	2.300E+02	1.535E+01
	5.95E+04	1.85E+01	8.18E+05	1.86E+01	2.317E+02	1.542E+01
	6.00E+04	1.85E+01	8.24E+05	1.86E+01	2.334E+02	1.549E+01
	6.05E+04	1.85E+01	8.30E+05	1.86E+01	2.351E+02	1.556E+01
	6.10E+04	1.85E+01	8.36E+05	1.86E+01	2.368E+02	1.563E+01
	6.15E+04	1.85E+01	8.42E+05	1.86E+01	2.385E+02	1.570E+01
	6.20E+04	1.85E+01	8.48E+05	1.86E+01	2.402E+02	1.577E+01
	6.25E+04	1.85E+01	8.54E+05	1.86E+01	2.419E+02	1.584E+01
	6.30E+04	1.85E+01	8.60E+05	1.86E+01	2.436E+02	1.591E+01
	6.35E+04	1.85E+01	8.66E+05	1.86E+01	2.453E+02	1.598E+01
	6.40E+04	1.85E+01	8.72E+05	1.86E+01	2.470E+02	1.605E+01
	6.45E+04	1.85E+01	8.78E+05	1.86E+01	2.487E+02	1.612E+01
	6.50E+04	1.85E+01	8.84E+05	1.86E+01	2.504E+02	1.619E+01
	6.55E+04	1.85E+01	8.90E+05	1.86E+01	2.521E+02	1.626E+01
	6.60E+04	1.85E+01	8.96E+05	1.86E+01	2.538E+02	1.633E+01
	6.65E+04	1.85E+01	9.02E+05	1.86E+01	2.555E+02	1.640E+01
	6.70E+04	1.85E+01	9.08E+05	1.86E+01	2.572E+02	1.647E+01
	6.75E+04	1.85E+01	9.14E+05	1.86E+01	2.589E+02	1.654E+01
	6.80E+04	1.85E+01	9.20E+05	1.86E+01	2.606E+02	1.661E+01
	6.85E+04	1.85E+01	9.26E+05	1.86E+01	2.623E+02	1.668E+01
	6.90E+04	1.85E+01	9.32E+05	1.86E+01	2.640E+02	1.675E+01
	6.95E+04	1.85E+01	9.38E+05	1.86E+01	2.657E+02	1.682E+01
	7.00E+04	1.85E+01	9.44E+05	1.86E+01	2.674E+02	1.689E+01
	7.05E+04	1.85E+01	9.50E+05	1.86E+01	2.691E+02	1.696E+01
	7.10E+04	1.85E+01	9.56E+05	1.86E+01	2.708E+02	1.703E+01
	7.15E+04	1.85E+01	9.62E+05	1.86E+01	2.725E+02	1.710E+01
	7.20E+04	1.85E+01	9.68E+05	1.86E+01	2.742E+02	1.717E+01
	7.25E+04	1.85E+01	9.74E+05	1.86E+01	2.759E+02	1.724E+01
	7.30E+04	1.85E+01	9.80E+05	1.86E+01	2.776	

Table 5a

Atomic Collisions and Pair Productions

1111X0=000 F7143395F-91 C1S0/11

MINIMUM AND RANGE TABLES

NUCLEAR

PARTIAL / TOTAL

ENERGY (GeV)

0.1 1 10 100

0.2 0.4 0.6 0.8

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

Table 5b

IRON
Atomic Collisions and Pair Productions

P (GeV/c)		N/E ₀ -TOT (GeV/c)		RANGE (cm)		COLLISION ALL (GeV/c)		PROD X- $\bar{\nu}$ PARTIAL NUCLEAR (GeV/c)	
1.174	0.144	1.174	0.144	1.174	0.144	1.174	0.144	1.174	0.144
1.174	0.288	1.174	0.288	1.174	0.288	1.174	0.288	1.174	0.288
1.174	0.576	1.174	0.576	1.174	0.576	1.174	0.576	1.174	0.576
1.174	1.152	1.174	1.152	1.174	1.152	1.174	1.152	1.174	1.152
1.174	2.304	1.174	2.304	1.174	2.304	1.174	2.304	1.174	2.304
1.174	4.608	1.174	4.608	1.174	4.608	1.174	4.608	1.174	4.608
1.174	9.216	1.174	9.216	1.174	9.216	1.174	9.216	1.174	9.216
1.174	18.432	1.174	18.432	1.174	18.432	1.174	18.432	1.174	18.432
1.174	36.864	1.174	36.864	1.174	36.864	1.174	36.864	1.174	36.864
1.174	73.728	1.174	73.728	1.174	73.728	1.174	73.728	1.174	73.728
1.174	147.456	1.174	147.456	1.174	147.456	1.174	147.456	1.174	147.456
1.174	294.912	1.174	294.912	1.174	294.912	1.174	294.912	1.174	294.912
1.174	589.824	1.174	589.824	1.174	589.824	1.174	589.824	1.174	589.824
1.174	1179.648	1.174	1179.648	1.174	1179.648	1.174	1179.648	1.174	1179.648
1.174	2359.296	1.174	2359.296	1.174	2359.296	1.174	2359.296	1.174	2359.296
1.174	4718.592	1.174	4718.592	1.174	4718.592	1.174	4718.592	1.174	4718.592
1.174	9437.184	1.174	9437.184	1.174	9437.184	1.174	9437.184	1.174	9437.184
1.174	18874.368	1.174	18874.368	1.174	18874.368	1.174	18874.368	1.174	18874.368
1.174	37748.736	1.174	37748.736	1.174	37748.736	1.174	37748.736	1.174	37748.736
1.174	75497.472	1.174	75497.472	1.174	75497.472	1.174	75497.472	1.174	75497.472
1.174	150994.944	1.174	150994.944	1.174	150994.944	1.174	150994.944	1.174	150994.944
1.174	301989.888	1.174	301989.888	1.174	301989.888	1.174	301989.888	1.174	301989.888
1.174	603979.776	1.174	603979.776	1.174	603979.776	1.174	603979.776	1.174	603979.776
1.174	1207959.552	1.174	1207959.552	1.174	1207959.552	1.174	1207959.552	1.174	1207959.552
1.174	2415919.104	1.174	2415919.104	1.174	2415919.104	1.174	2415919.104	1.174	2415919.104
1.174	4831838.208	1.174	4831838.208	1.174	4831838.208	1.174	4831838.208	1.174	4831838.208
1.174	9663676.416	1.174	9663676.416	1.174	9663676.416	1.174	9663676.416	1.174	9663676.416
1.174	19327352.832	1.174	19327352.832	1.174	19327352.832	1.174	19327352.832	1.174	19327352.832
1.174	38654705.664	1.174	38654705.664	1.174	38654705.664	1.174	38654705.664	1.174	38654705.664
1.174	77309411.328	1.174	77309411.328	1.174	77309411.328	1.174	77309411.328	1.174	77309411.328
1.174	154618822.656	1.174	154618822.656	1.174	154618822.656	1.174	154618822.656	1.174	154618822.656
1.174	309237645.312	1.174	309237645.312	1.174	309237645.312	1.174	309237645.312	1.174	309237645.312
1.174	618475290.624	1.174	618475290.624	1.174	618475290.624	1.174	618475290.624	1.174	618475290.624
1.174	1236950581.248	1.174	1236950581.248	1.174	1236950581.248	1.174	1236950581.248	1.174	1236950581.248
1.174	2473901162.496	1.174	2473901162.496	1.174	2473901162.496	1.174	2473901162.496	1.174	2473901162.496
1.174	4947802324.992	1.174	4947802324.992	1.174	4947802324.992	1.174	4947802324.992	1.174	4947802324.992
1.174	9895604649.984	1.174	9895604649.984	1.174	9895604649.984	1.174	9895604649.984	1.174	9895604649.984
1.174	19791209299.968	1.174	19791209299.968	1.174	19791209299.968	1.174	19791209299.968	1.174	19791209299.968
1.174	39582418599.936	1.174	39582418599.936	1.174	39582418599.936	1.174	39582418599.936	1.174	39582418599.936
1.174	79164837199.904	1.174	79164837199.904	1.174	79164837199.904	1.174	79164837199.904	1.174	79164837199.904
1.174	158329674399.872	1.174	158329674399.872	1.174	158329674399.872	1.174	158329674399.872	1.174	158329674399.872
1.174	316659348799.744	1.174	316659348799.744	1.174	316659348799.744	1.174	316659348799.744	1.174	316659348799.744
1.174	633318697599.712	1.174	633318697599.712	1.174	633318697599.712	1.174	633318697599.712	1.174	633318697599.712
1.174	1266637395199.68	1.174	1266637395199.68	1.174	1266637395199.68	1.174	1266637395199.68	1.174	1266637395199.68
1.174	2533274790399.648	1.174	2533274790399.648	1.174	2533274790399.648	1.174	2533274790399.648	1.174	2533274790399.648
1.174	5066549580799.616	1.174	5066549580799.616	1.174	5066549580799.616	1.174	5066549580799.616	1.174	5066549580799.616
1.174	10133099161599.584	1.174	10133099161599.584	1.174	10133099161599.584	1.174	10133099161599.584	1.174	10133099161599.584
1.174	20266198323199.552	1.174	20266198323199.552	1.174	20266198323199.552	1.174	20266198323199.552	1.174	20266198323199.552
1.174	40532396646399.512	1.174	40532396646399.512	1.174	40532396646399.512	1.174	40532396646399.512	1.174	40532396646399.512
1.174	81064793292799.472	1.174	81064793292799.472	1.174	81064793292799.472	1.174	81064793292799.472	1.174	81064793292799.472
1.174	162129586585599.432	1.174	162129586585599.432	1.174	162129586585599.432	1.174	162129586585599.432	1.174	162129586585599.432
1.174	324259173171199.392	1.174	324259173171199.392	1.174	324259173171199.392	1.174	324259173171199.392	1.174	324259173171199.392
1.174	648518346342399.352	1.174	648518346342399.352	1.174	648518346342399.352	1.174	648518346342399.352	1.174	648518346342399.352
1.174	1297036692684799.312	1.174	1297036692684799.312	1.174	1297036692684799.312	1.174	1297036692684799.312	1.174	1297036692684799.312
1.174	2594073385369599.272	1.174	2594073385369599.272	1.174	2594073385369599.272	1.174	2594073385369599.272	1.174	2594073385369599.272
1.174	5188146770739199.232	1.174	5188146770739199.232	1.174	5188146770739199.232	1.174	5188146770739199.232	1.174	5188146770739199.232
1.174	10376293541478399.192	1.174	10376293541478399.192	1.174	10376293541478399.192	1.174	10376293541478399.192	1.174	10376293541478399.192
1.174	20752587082956799.152	1.174	20752587082956799.152	1.174	20752587082956799.152	1.174	20752587082956799.152	1.174	20752587082956799.152
1.174	41505174165913599.112	1.174	41505174165913599.112	1.174	41505174165913599.112	1.174	41505174165913599.112	1.174	41505174165913599.112
1.174	83010348331827199.072	1.174	83010348331827199.072	1.174	83010348331827199.072	1.174	83010348331827199.072	1.174	83010348331827199.072
1.174	166020696663654399.032	1.174	166020696663654399.032	1.174	166020696663654399.032	1.174	166020696663654399.032	1.174	166020696663654399.032
1.174	332041393327308799.032	1.174	332041393327308799.032	1.174	332041393327308799.032	1.174	332041393327308799.032	1.174	332041393327308799.032
1.174	664082786654617599.032	1.174	664082786654617599.032	1.174	664082786654617599.032	1.174	664082786654617599.032	1.174	664082786654617599.032
1.174	132816557330923599.032	1.174	132816557330923599.032	1.174	132816557330923599.032	1.174	132816557330923599.032	1.174	132816557330923599.032
1.174	265633114661847199.032	1.174	265633114661847199.032	1.174	265633114661847199.032	1.174	265633114661847199.032	1.174	265633114661847199.032
1.174	531266229323694399.032	1.174	531266229323694399.032	1.174	531266229323694399.032	1.174	531266229323694399.032	1.174	531266229323694399.032
1.174	1062532458647388799.032	1.174	1062532458647388799.032	1.174	1062532458647388799.032	1.174	1062532458647388799.032	1.174	1062532458647388799.032
1.174	2125064917294777599.032	1.174	2125064917294777599.032	1.174	2125064917294777599.032	1.174	2125064917294777599.032	1.174	2125064917294777599.032
1.174	4250129834589555199.032	1.174	4250129834589555199.032	1.174	4250129834589555199.032	1.174	4250129834589555199.032	1.174	4250129834589555199.032
1.174	8500259669179110399.032	1.174	8500259669179110399.032	1.174	8500259669179110399.032	1.174	8500259669179110399.032	1.174	8500259669179110399.032
1.174	17000519338358220799.032	1.174	17000519338358220799.032	1.174	17000519338358220799.032	1.174	17000519338358220799.032	1.174	

Table 5C

Atomic Collisions and Pair Productions

Table 5d

IRON

Atomic Collisions and Pair Productions

E	P	$D\sigma/dx - TOT$	RANGE	(CM)	(ET)	COLLISION CALL IN	PAIR PROD	$D\sigma/dx - PARTIAL$	BREMSSTRAL	NUCLEAR
(GeV)	(GeV/c)	(MeV/cG/cmsq)	(cm)	(cm)	(cm)	IN MEV/G/cCMSQ	IN MEV/G/cCMSQ	IN MEV/G/cCMSQ	IN MEV/G/cCMSQ	IN MEV/G/cCMSQ
5.31E+03	5.31E+03	4.17E+01	1.97E+06	2.61E+05	8.21E+03	2.39E+01	1.79E+01	4.23E+01	4.23E+00	
5.50E+03	5.50E+03	4.13E+01	2.02E+06	2.61E+05	8.21E+03	2.39E+01	1.85E+01	4.30E+01	4.30E+00	
5.52E+03	5.52E+03	4.20E+01	2.06E+06	2.61E+05	8.21E+03	2.39E+01	1.92E+01	4.36E+01	4.36E+00	
5.64E+03	5.64E+03	4.27E+01	2.11E+06	2.61E+05	8.21E+03	2.39E+01	1.99E+01	4.42E+01	4.42E+00	
5.68E+03	5.68E+03	4.34E+01	2.15E+06	2.61E+05	8.21E+03	2.39E+01	2.07E+01	4.48E+01	4.48E+00	
5.70E+03	5.70E+03	4.40E+01	2.20E+06	2.61E+05	8.21E+03	2.39E+01	2.14E+01	4.54E+01	4.54E+00	
5.72E+03	5.72E+03	4.47E+01	2.25E+06	2.61E+05	8.21E+03	2.39E+01	2.21E+01	4.60E+01	4.60E+00	
5.74E+03	5.74E+03	4.54E+01	2.29E+06	2.92E+05	9.57E+03	2.31E+01	2.24E+01	4.66E+01	4.66E+00	
5.76E+03	5.76E+03	4.60E+01	2.34E+06	2.97E+05	9.75E+03	2.30E+01	2.31E+01	4.72E+01	4.72E+00	
5.78E+03	5.78E+03	4.67E+01	2.38E+06	3.13E+05	9.93E+03	2.30E+01	2.37E+01	4.78E+01	4.78E+00	
5.80E+03	5.80E+03	4.74E+01	2.42E+06	3.09E+05	1.01E+04	2.30E+01	2.42E+01	4.84E+01	4.84E+00	
5.83E+03	5.83E+03	4.81E+01	2.46E+06	3.13E+05	1.03E+04	2.30E+01	2.48E+01	4.90E+01	4.90E+00	
5.92E+03	5.92E+03	4.88E+01	2.51E+06	3.19E+05	1.05E+04	2.31E+01	2.57E+01	5.07E+01	5.07E+00	
5.94E+03	5.94E+03	4.94E+01	2.55E+06	3.24E+05	1.16E+04	2.31E+01	2.62E+01	5.13E+01	5.13E+00	
5.98E+03	5.98E+03	5.01E+01	2.59E+06	3.29E+05	1.08E+04	2.31E+01	2.67E+01	5.20E+01	5.20E+00	
5.99E+03	5.99E+03	5.07E+01	2.63E+06	3.34E+05	1.10E+04	2.31E+01	2.72E+01	5.26E+01	5.26E+00	
6.00E+03	6.00E+03	5.14E+01	2.67E+06	3.39E+05	1.11E+04	2.31E+01	2.77E+01	5.32E+01	5.32E+00	
6.02E+03	6.02E+03	5.21E+01	2.70E+06	3.44E+05	1.13E+04	2.31E+01	2.82E+01	5.38E+01	5.38E+00	
6.04E+03	6.04E+03	5.28E+01	2.74E+06	3.49E+05	1.14E+04	2.31E+01	2.87E+01	5.44E+01	5.44E+00	
6.06E+03	6.06E+03	5.35E+01	2.78E+06	3.54E+05	1.16E+04	2.32E+01	2.93E+01	5.50E+01	5.50E+00	
6.08E+03	6.08E+03	5.42E+01	2.82E+06	3.59E+05	1.18E+04	2.32E+01	2.98E+01	5.56E+01	5.56E+00	
6.10E+03	6.10E+03	5.49E+01	2.86E+06	3.64E+05	1.19E+04	2.32E+01	3.03E+01	5.62E+01	5.62E+00	
6.12E+03	6.12E+03	5.56E+01	2.90E+06	3.69E+05	1.21E+04	2.32E+01	3.08E+01	5.68E+01	5.68E+00	
6.14E+03	6.14E+03	5.63E+01	2.93E+06	3.73E+05	1.22E+04	2.32E+01	3.13E+01	5.74E+01	5.74E+00	
6.16E+03	6.16E+03	5.70E+01	2.97E+06	3.78E+05	1.24E+04	2.32E+01	3.18E+01	5.80E+01	5.80E+00	
6.18E+03	6.18E+03	5.77E+01	3.01E+06	3.83E+05	1.26E+04	2.32E+01	3.23E+01	5.86E+01	5.86E+00	
6.20E+03	6.20E+03	5.84E+01	3.05E+06	3.88E+05	1.27E+04	2.33E+01	3.28E+01	5.92E+01	5.92E+00	
6.22E+03	6.22E+03	5.91E+01	3.09E+06	3.93E+05	1.29E+04	2.33E+01	3.33E+01	5.98E+01	5.98E+00	
6.24E+03	6.24E+03	5.98E+01	3.13E+06	3.98E+05	1.31E+04	2.33E+01	3.38E+01	6.04E+01	6.04E+00	
6.26E+03	6.26E+03	6.05E+01	3.17E+06	4.03E+05	1.33E+04	2.33E+01	3.43E+01	6.10E+01	6.10E+00	
6.28E+03	6.28E+03	6.12E+01	3.21E+06	4.08E+05	1.35E+04	2.33E+01	3.48E+01	6.16E+01	6.16E+00	
6.30E+03	6.30E+03	6.19E+01	3.25E+06	4.13E+05	1.37E+04	2.33E+01	3.53E+01	6.22E+01	6.22E+00	
6.32E+03	6.32E+03	6.26E+01	3.29E+06	4.18E+05	1.39E+04	2.33E+01	3.58E+01	6.28E+01	6.28E+00	
6.34E+03	6.34E+03	6.33E+01	3.33E+06	4.23E+05	1.41E+04	2.33E+01	3.63E+01	6.34E+01	6.34E+00	
6.36E+03	6.36E+03	6.40E+01	3.37E+06	4.28E+05	1.43E+04	2.33E+01	3.68E+01	6.40E+01	6.40E+00	
6.38E+03	6.38E+03	6.47E+01	3.41E+06	4.33E+05	1.45E+04	2.33E+01	3.73E+01	6.46E+01	6.46E+00	
6.40E+03	6.40E+03	6.54E+01	3.45E+06	4.38E+05	1.47E+04	2.33E+01	3.78E+01	6.52E+01	6.52E+00	
6.42E+03	6.42E+03	6.61E+01	3.49E+06	4.43E+05	1.49E+04	2.33E+01	3.83E+01	6.58E+01	6.58E+00	
6.44E+03	6.44E+03	6.68E+01	3.53E+06	4.48E+05	1.51E+04	2.33E+01	3.88E+01	6.64E+01	6.64E+00	
6.46E+03	6.46E+03	6.75E+01	3.57E+06	4.53E+05	1.53E+04	2.33E+01	3.93E+01	6.70E+01	6.70E+00	
6.48E+03	6.48E+03	6.82E+01	3.61E+06	4.58E+05	1.55E+04	2.33E+01	3.98E+01	6.76E+01	6.76E+00	
6.50E+03	6.50E+03	6.89E+01	3.65E+06	4.63E+05	1.57E+04	2.33E+01	4.03E+01	6.82E+01	6.82E+00	
6.52E+03	6.52E+03	6.96E+01	3.69E+06	4.68E+05	1.59E+04	2.33E+01	4.08E+01	6.88E+01	6.88E+00	
6.54E+03	6.54E+03	7.03E+01	3.73E+06	4.73E+05	1.61E+04	2.33E+01	4.13E+01	6.94E+01	6.94E+00	
6.56E+03	6.56E+03	7.10E+01	3.77E+06	4.78E+05	1.63E+04	2.33E+01	4.18E+01	7.00E+01	7.00E+00	
6.58E+03	6.58E+03	7.17E+01	3.81E+06	4.83E+05	1.65E+04	2.33E+01	4.23E+01	7.06E+01	7.06E+00	
6.60E+03	6.60E+03	7.24E+01	3.85E+06	4.88E+05	1.67E+04	2.33E+01	4.28E+01	7.12E+01	7.12E+00	
6.62E+03	6.62E+03	7.31E+01	3.89E+06	4.93E+05	1.69E+04	2.33E+01	4.33E+01	7.18E+01	7.18E+00	
6.64E+03	6.64E+03	7.38E+01	3.93E+06	4.98E+05	1.71E+04	2.33E+01	4.38E+01	7.24E+01	7.24E+00	
6.66E+03	6.66E+03	7.45E+01	3.97E+06	5.03E+05	1.73E+04	2.33E+01	4.43E+01	7.30E+01	7.30E+00	
6.68E+03	6.68E+03	7.52E+01	4.01E+06	5.08E+05	1.75E+04	2.33E+01	4.48E+01	7.36E+01	7.36E+00	
6.70E+03	6.70E+03	7.59E+01	4.05E+06	5.13E+05	1.77E+04	2.33E+01	4.53E+01	7.42E+01	7.42E+00	
6.72E+03	6.72E+03	7.66E+01	4.09E+06	5.18E+05	1.79E+04	2.33E+01	4.58E+01	7.48E+01	7.48E+00	
6.74E+03	6.74E+03	7.73E+01	4.13E+06	5.23E+05	1.81E+04	2.33E+01	4.63E+01	7.54E+01	7.54E+00	
6.76E+03	6.76E+03	7.80E+01	4.17E+06	5.28E+05	1.83E+04	2.33E+01	4.68E+01	7.60E+01	7.60E+00	
6.78E+03	6.78E+03	7.87E+01	4.21E+06	5.33E+05	1.85E+04	2.33E+01	4.73E+01	7.66E+01	7.66E+00	
6.80E+03	6.80E+03	7.94E+01	4.25E+06	5.38E+05	1.87E+04	2.33E+01	4.78E+01	7.72E+01	7.72E+00	
6.82E+03	6.82E+03	8.01E+01	4.29E+06	5.43E+05	1.89E+04	2.33E+01	4.83E+01	7.78E+01	7.78E+00	
6.84E+03	6.84E+03	8.08E+01	4.33E+06	5.48E+05	1.91E+04	2.33E+01	4.88E+01	7.84E+01	7.84E+00	
6.86E+03	6.86E+03	8.15E+01	4.37E+06	5.53E+05	1.93E+04	2.33E+01	4.93E+01	7.90E+01	7.90E+00	
6.88E+03	6.88E+03	8.22E+01	4.41E+06	5.58E+05	1.95E+04	2.33E+01	4.98E+01	7.96E+01	7.96E+00	
6.90E+03	6.90E+03	8.29E+01	4.45E+06	5.63E+05	1.97E+04	2.33E+01	5.03E+01	8.02E+01	8.02E+00	
6.92E+03	6.92E+03	8.36E+01	4.49E+06	5.68E+05	1.99E+04	2.33E+01	5.08E+01	8.08E+01	8.08E+00	
6.94E+03	6.94E+03	8.43E+01	4.53E+06	5.73E+05	2.01E+04	2.33E+01	5.13E+01	8.14E+01	8.14E+00	
6.96E+03	6.96E+03	8.50E+01	4.57E+06	5.78E+05	2.03E+04	2.33E+01	5.18E+01	8.20E+01	8.20E+00	
6.98E+03	6.98E+03	8.57E+01	4.61E+06	5.83E+05	2.05E+04	2.33E+01	5.23E+01	8.26E+01	8.26E+00	
7.00E+03	7.00E+03	8.64E+01	4.65E+06	5.88E+05	2.07E+04	2.33E+01	5.28E+01	8.32E+01	8.32E+00	
7.02E+03	7.02E+03	8.71E+01	4.69E+06	5.93E+05	2.09E+04	2.33E+01	5.33E+01	8.38E+01	8.38E+00	
7.04E+03	7.04E+03	8.78E+01	4.73E+06	5.98E+05	2.11E+04	2.33E+01	5.38E+01	8.44E+01	8.44E+00	
7.06E+03	7.06E+03	8.85E+01	4.77E+06	6.03E+05	2.13E+04	2.33E+01	5.43E+01	8.50E+01	8.50E+00	
7.08E+03	7.08E+03	8.92E+01	4.81E+06	6.08E+05	2.15E+04	2.33E+01	5.48E+01	8.56E+01	8.56E+00	
7.10E+03	7.10E+03	8.99E+01	4.85E+06	6.13E+05	2.17E+04	2.33E+01	5.53E+01	8.62E+01	8.62E+00	
7.12E+03	7.12E+03	9.06E+01	4.89E+06	6.18E+05	2.19E+04	2.33E+01	5.58E+01	8.68E+01	8.68E+00	
7.14E+03	7.14E+03	9.13E+01	4.93E+06	6.23E+05	2.21E+04	2.33E+01	5.63E+01	8.74E+01	8.74E+00	
7.16E+03	7.16E+03	9.20E+01	4.97E+06	6.28E+05	2.23E+04	2.33E+01	5.68E+01	8.80E+01	8.80E+00	
7.18E+03	7.18E+03	9.27E+01	5.01E+06	6.33E+05	2.25E+04	2.33E+01	5.73E+01	8.86E+01	8.86E+00	
7.20E+03	7.20E+03	9.34E+01	5.05E+06	6.38E+05	2.27E+04	2.33E+01	5.78E+01	8.92E+01	8.92E+00	
7.22E+03	7.22E+03	9.41E+01	5.09E+06	6.43E+05	2.29E+04	2.33E+01	5.83E+01	8.98E+01	8.98E+00	
7.24E+03	7.24E+03	9.48E+01	5.13E+06	6.48E+05	2.31E+04	2.33E+01	5.88E+01	9.04E+01	9.04E+00	
7.26E+03	7.26E+03	9.55E+01	5.1							

Table 6a

Atomic Collisions and Pair Productions

Table 6b

SOIL
Atomic Collisions and Pair Productions

E (GeV)	P (GeV/c)	D ₁ /D ₀ X-TOT CH ₂ /(CH ₂ +C ₆ H ₆)	D ₁ /D ₀ X-TOT C ₆ H ₆ /(CH ₂ +C ₆ H ₆)	RANGE (CM)		COLLISION PAIR ALL PAIRS		PROTONIC PAIRS		DEUTERONIC PAIRS		NUCLEAR PAIRS	
				10 ⁻¹	10 ⁻²	10 ⁻¹	10 ⁻²	10 ⁻¹	10 ⁻²	10 ⁻¹	10 ⁻²	10 ⁻¹	10 ⁻²
2.00	2.50E+01	1.74E+04	1.74E+04	6.71E+03	2.20E+02	1.83E+01	1.11E+01	1.23E+01	1.11E+01	1.75E+01	1.44E+01	1.79E+01	1.44E+01
2.50	2.50E+01	1.49E+04	1.49E+04	7.24E+03	2.17E+02	1.39E+01	1.03E+01	1.13E+01	1.03E+01	1.60E+01	1.30E+01	1.65E+01	1.30E+01
3.00	2.50E+01	1.25E+04	1.25E+04	7.76E+03	2.05E+02	1.39E+01	1.01E+01	1.19E+01	1.01E+01	1.52E+01	1.21E+01	1.57E+01	1.21E+01
3.50	2.50E+01	1.03E+04	1.03E+04	8.29E+03	1.93E+02	1.39E+01	9.90E+00	1.19E+01	9.90E+00	1.44E+01	1.18E+01	1.49E+01	1.18E+01
4.00	2.50E+01	8.34E+03	8.34E+03	8.84E+03	1.82E+02	1.39E+01	9.62E+00	1.19E+01	9.62E+00	1.37E+01	1.15E+01	1.41E+01	1.15E+01
4.50	2.50E+01	6.50E+03	6.50E+03	9.47E+03	1.71E+02	1.39E+01	9.34E+00	1.19E+01	9.34E+00	1.25E+01	1.12E+01	1.45E+01	1.12E+01
5.00	2.50E+01	5.00E+03	5.00E+03	1.01E+04	1.60E+02	1.39E+01	9.07E+00	1.19E+01	9.07E+00	1.21E+01	1.09E+01	1.47E+01	1.09E+01
5.50	2.50E+01	4.00E+03	4.00E+03	1.08E+04	1.49E+02	1.39E+01	8.84E+00	1.19E+01	8.84E+00	1.19E+01	1.07E+01	1.49E+01	1.07E+01
6.00	2.50E+01	3.00E+03	3.00E+03	1.15E+04	1.38E+02	1.39E+01	8.61E+00	1.19E+01	8.61E+00	1.19E+01	1.05E+01	1.51E+01	1.05E+01
6.50	2.50E+01	2.20E+03	2.20E+03	1.22E+04	1.27E+02	1.39E+01	8.38E+00	1.19E+01	8.38E+00	1.19E+01	1.03E+01	1.53E+01	1.03E+01
7.00	2.50E+01	1.50E+03	1.50E+03	1.30E+04	1.16E+02	1.39E+01	8.15E+00	1.19E+01	8.15E+00	1.19E+01	1.01E+01	1.55E+01	1.01E+01
7.50	2.50E+01	1.00E+03	1.00E+03	1.38E+04	1.05E+02	1.39E+01	7.92E+00	1.19E+01	7.92E+00	1.19E+01	9.9E+00	1.57E+01	9.9E+00
8.00	2.50E+01	6.67E+02	6.67E+02	1.46E+04	9.4E+01	1.39E+01	7.69E+00	1.19E+01	7.69E+00	1.19E+01	9.7E+00	1.59E+01	9.7E+00
8.50	2.50E+01	4.44E+02	4.44E+02	1.54E+04	8.3E+01	1.39E+01	7.46E+00	1.19E+01	7.46E+00	1.19E+01	9.5E+00	1.61E+01	9.5E+00
9.00	2.50E+01	2.96E+02	2.96E+02	1.62E+04	7.2E+01	1.39E+01	7.23E+00	1.19E+01	7.23E+00	1.19E+01	9.3E+00	1.63E+01	9.3E+00
9.50	2.50E+01	1.80E+02	1.80E+02	1.70E+04	6.1E+01	1.39E+01	6.99E+00	1.19E+01	6.99E+00	1.19E+01	9.1E+00	1.65E+01	9.1E+00
10.00	2.50E+01	1.00E+02	1.00E+02	1.78E+04	5.0E+01	1.39E+01	6.76E+00	1.19E+01	6.76E+00	1.19E+01	8.9E+00	1.67E+01	8.9E+00
10.50	2.50E+01	5.56E+01	5.56E+01	1.86E+04	3.9E+01	1.39E+01	6.52E+00	1.19E+01	6.52E+00	1.19E+01	8.7E+00	1.69E+01	8.7E+00
11.00	2.50E+01	3.08E+01	3.08E+01	1.94E+04	2.8E+01	1.39E+01	6.29E+00	1.19E+01	6.29E+00	1.19E+01	8.5E+00	1.71E+01	8.5E+00
11.50	2.50E+01	1.64E+01	1.64E+01	2.02E+04	1.7E+01	1.39E+01	6.06E+00	1.19E+01	6.06E+00	1.19E+01	8.3E+00	1.73E+01	8.3E+00
12.00	2.50E+01	8.20E+00	8.20E+00	2.10E+04	6.6E+00	1.39E+01	5.83E+00	1.19E+01	5.83E+00	1.19E+01	8.1E+00	1.75E+01	8.1E+00
12.50	2.50E+01	4.10E+00	4.10E+00	2.18E+04	5.5E+00	1.39E+01	5.60E+00	1.19E+01	5.60E+00	1.19E+01	7.9E+00	1.77E+01	7.9E+00
13.00	2.50E+01	2.05E+00	2.05E+00	2.26E+04	4.4E+00	1.39E+01	5.37E+00	1.19E+01	5.37E+00	1.19E+01	7.7E+00	1.79E+01	7.7E+00
13.50	2.50E+01	1.02E+00	1.02E+00	2.34E+04	3.3E+00	1.39E+01	5.14E+00	1.19E+01	5.14E+00	1.19E+01	7.5E+00	1.81E+01	7.5E+00
14.00	2.50E+01	5.10E-01	5.10E-01	2.42E+04	2.2E+00	1.39E+01	4.91E+00	1.19E+01	4.91E+00	1.19E+01	7.3E+00	1.83E+01	7.3E+00
14.50	2.50E+01	2.55E-01	2.55E-01	2.50E+04	1.1E+00	1.39E+01	4.68E+00	1.19E+01	4.68E+00	1.19E+01	7.1E+00	1.85E+01	7.1E+00
15.00	2.50E+01	1.27E-01	1.27E-01	2.58E+04	1.0E+00	1.39E+01	4.45E+00	1.19E+01	4.45E+00	1.19E+01	6.9E+00	1.87E+01	6.9E+00
15.50	2.50E+01	5.35E-02	5.35E-02	2.66E+04	9.0E-01	1.39E+01	4.22E+00	1.19E+01	4.22E+00	1.19E+01	6.7E+00	1.89E+01	6.7E+00
16.00	2.50E+01	2.27E-02	2.27E-02	2.74E+04	8.0E-01	1.39E+01	4.00E+00	1.19E+01	4.00E+00	1.19E+01	6.5E+00	1.91E+01	6.5E+00
16.50	2.50E+01	9.10E-03	9.10E-03	2.82E+04	7.0E-01	1.39E+01	3.77E+00	1.19E+01	3.77E+00	1.19E+01	6.3E+00	1.93E+01	6.3E+00
17.00	2.50E+01	3.64E-03	3.64E-03	2.90E+04	6.0E-01	1.39E+01	3.54E+00	1.19E+01	3.54E+00	1.19E+01	6.1E+00	1.95E+01	6.1E+00
17.50	2.50E+01	1.41E-03	1.41E-03	2.98E+04	5.0E-01	1.39E+01	3.31E+00	1.19E+01	3.31E+00	1.19E+01	5.9E+00	1.97E+01	5.9E+00
18.00	2.50E+01	5.04E-04	5.04E-04	3.06E+04	4.0E-01	1.39E+01	3.08E+00	1.19E+01	3.08E+00	1.19E+01	5.7E+00	1.99E+01	5.7E+00
18.50	2.50E+01	1.81E-04	1.81E-04	3.14E+04	3.0E-01	1.39E+01	2.85E+00	1.19E+01	2.85E+00	1.19E+01	5.5E+00	2.01E+01	5.5E+00
19.00	2.50E+01	6.04E-05	6.04E-05	3.22E+04	2.0E-01	1.39E+01	2.62E+00	1.19E+01	2.62E+00	1.19E+01	5.3E+00	2.03E+01	5.3E+00
19.50	2.50E+01	2.01E-05	2.01E-05	3.30E+04	1.0E-01	1.39E+01	2.39E+00	1.19E+01	2.39E+00	1.19E+01	5.1E+00	2.05E+01	5.1E+00
20.00	2.50E+01	6.71E-06	6.71E-06	3.38E+04	0.0E+00	1.39E+01	2.16E+00	1.19E+01	2.16E+00	1.19E+01	4.9E+00	2.07E+01	4.9E+00

Table 6c

SOIL Atomic Collisions and Pair Productions

Table 6d

SOIL Atomic Collisions and Pair Productions

Table 7a

Atomic Collisions and Pair Productions

MUON GE/OX AND RANGE TABLES		GE/OX-2 PARTIAL		GE/OX-2 PARTIAL NUCLEAR	
RANGE		COLLISION (ALL IN MEV/NUCLEAR)		COLLISION (PART IN MEV/NUCLEAR)	
(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)
1.000000	0.15302995+0.0	CM50764	CM50764	CM50764	CM50764
1.10 = 2	1.5302995+0.0	1.5302995+0.0	1.5302995+0.0	1.5302995+0.0	1.5302995+0.0
1.20	1.8333333+0.0	1.8333333+0.0	1.8333333+0.0	1.8333333+0.0	1.8333333+0.0
1.30	2.1428571+0.0	2.1428571+0.0	2.1428571+0.0	2.1428571+0.0	2.1428571+0.0
1.40	2.4691358+0.0	2.4691358+0.0	2.4691358+0.0	2.4691358+0.0	2.4691358+0.0
1.50	2.8038919+0.0	2.8038919+0.0	2.8038919+0.0	2.8038919+0.0	2.8038919+0.0
1.60	3.1469389+0.0	3.1469389+0.0	3.1469389+0.0	3.1469389+0.0	3.1469389+0.0
1.70	3.5083333+0.0	3.5083333+0.0	3.5083333+0.0	3.5083333+0.0	3.5083333+0.0
1.80	3.8875000+0.0	3.8875000+0.0	3.8875000+0.0	3.8875000+0.0	3.8875000+0.0
1.90	4.2750000+0.0	4.2750000+0.0	4.2750000+0.0	4.2750000+0.0	4.2750000+0.0
2.00	4.6718750+0.0	4.6718750+0.0	4.6718750+0.0	4.6718750+0.0	4.6718750+0.0
2.10	5.0775000+0.0	5.0775000+0.0	5.0775000+0.0	5.0775000+0.0	5.0775000+0.0
2.20	5.4920833+0.0	5.4920833+0.0	5.4920833+0.0	5.4920833+0.0	5.4920833+0.0
2.30	5.9156250+0.0	5.9156250+0.0	5.9156250+0.0	5.9156250+0.0	5.9156250+0.0
2.40	6.3481250+0.0	6.3481250+0.0	6.3481250+0.0	6.3481250+0.0	6.3481250+0.0
2.50	6.7905417+0.0	6.7905417+0.0	6.7905417+0.0	6.7905417+0.0	6.7905417+0.0
2.60	7.2428571+0.0	7.2428571+0.0	7.2428571+0.0	7.2428571+0.0	7.2428571+0.0
2.70	7.7051028+0.0	7.7051028+0.0	7.7051028+0.0	7.7051028+0.0	7.7051028+0.0
2.80	8.1772727+0.0	8.1772727+0.0	8.1772727+0.0	8.1772727+0.0	8.1772727+0.0
2.90	8.6593636+0.0	8.6593636+0.0	8.6593636+0.0	8.6593636+0.0	8.6593636+0.0
3.00	9.1413750+0.0	9.1413750+0.0	9.1413750+0.0	9.1413750+0.0	9.1413750+0.0
3.10	9.6333077+0.0	9.6333077+0.0	9.6333077+0.0	9.6333077+0.0	9.6333077+0.0
3.20	1.0152500+0.0	1.0152500+0.0	1.0152500+0.0	1.0152500+0.0	1.0152500+0.0
3.30	1.0681250+0.0	1.0681250+0.0	1.0681250+0.0	1.0681250+0.0	1.0681250+0.0
3.40	1.1220278+0.0	1.1220278+0.0	1.1220278+0.0	1.1220278+0.0	1.1220278+0.0
3.50	1.1769500+0.0	1.1769500+0.0	1.1769500+0.0	1.1769500+0.0	1.1769500+0.0
3.60	1.2328824+0.0	1.2328824+0.0	1.2328824+0.0	1.2328824+0.0	1.2328824+0.0
3.70	1.2898247+0.0	1.2898247+0.0	1.2898247+0.0	1.2898247+0.0	1.2898247+0.0
3.80	1.3477767+0.0	1.3477767+0.0	1.3477767+0.0	1.3477767+0.0	1.3477767+0.0
3.90	1.4067383+0.0	1.4067383+0.0	1.4067383+0.0	1.4067383+0.0	1.4067383+0.0
4.00	1.4667095+0.0	1.4667095+0.0	1.4667095+0.0	1.4667095+0.0	1.4667095+0.0
4.10	1.5276903+0.0	1.5276903+0.0	1.5276903+0.0	1.5276903+0.0	1.5276903+0.0
4.20	1.5896807+0.0	1.5896807+0.0	1.5896807+0.0	1.5896807+0.0	1.5896807+0.0
4.30	1.6526807+0.0	1.6526807+0.0	1.6526807+0.0	1.6526807+0.0	1.6526807+0.0
4.40	1.7167003+0.0	1.7167003+0.0	1.7167003+0.0	1.7167003+0.0	1.7167003+0.0
4.50	1.7817400+0.0	1.7817400+0.0	1.7817400+0.0	1.7817400+0.0	1.7817400+0.0
4.60	1.8478000+0.0	1.8478000+0.0	1.8478000+0.0	1.8478000+0.0	1.8478000+0.0
4.70	1.9148800+0.0	1.9148800+0.0	1.9148800+0.0	1.9148800+0.0	1.9148800+0.0
4.80	1.9829800+0.0	1.9829800+0.0	1.9829800+0.0	1.9829800+0.0	1.9829800+0.0
4.90	2.0521000+0.0	2.0521000+0.0	2.0521000+0.0	2.0521000+0.0	2.0521000+0.0
5.00	2.1222400+0.0	2.1222400+0.0	2.1222400+0.0	2.1222400+0.0	2.1222400+0.0
5.10	2.1934000+0.0	2.1934000+0.0	2.1934000+0.0	2.1934000+0.0	2.1934000+0.0
5.20	2.2655800+0.0	2.2655800+0.0	2.2655800+0.0	2.2655800+0.0	2.2655800+0.0
5.30	2.3387800+0.0	2.3387800+0.0	2.3387800+0.0	2.3387800+0.0	2.3387800+0.0
5.40	2.4129900+0.0	2.4129900+0.0	2.4129900+0.0	2.4129900+0.0	2.4129900+0.0
5.50	2.4882100+0.0	2.4882100+0.0	2.4882100+0.0	2.4882100+0.0	2.4882100+0.0
5.60	2.5644400+0.0	2.5644400+0.0	2.5644400+0.0	2.5644400+0.0	2.5644400+0.0
5.70	2.6416800+0.0	2.6416800+0.0	2.6416800+0.0	2.6416800+0.0	2.6416800+0.0
5.80	2.7199300+0.0	2.7199300+0.0	2.7199300+0.0	2.7199300+0.0	2.7199300+0.0
5.90	2.7992000+0.0	2.7992000+0.0	2.7992000+0.0	2.7992000+0.0	2.7992000+0.0
6.00	2.8795000+0.0	2.8795000+0.0	2.8795000+0.0	2.8795000+0.0	2.8795000+0.0
6.10	2.9610200+0.0	2.9610200+0.0	2.9610200+0.0	2.9610200+0.0	2.9610200+0.0
6.20	3.0436600+0.0	3.0436600+0.0	3.0436600+0.0	3.0436600+0.0	3.0436600+0.0
6.30	3.1274200+0.0	3.1274200+0.0	3.1274200+0.0	3.1274200+0.0	3.1274200+0.0
6.40	3.2122000+0.0	3.2122000+0.0	3.2122000+0.0	3.2122000+0.0	3.2122000+0.0
6.50	3.3080000+0.0	3.3080000+0.0	3.3080000+0.0	3.3080000+0.0	3.3080000+0.0
6.60	3.4058200+0.0	3.4058200+0.0	3.4058200+0.0	3.4058200+0.0	3.4058200+0.0
6.70	3.5046600+0.0	3.5046600+0.0	3.5046600+0.0	3.5046600+0.0	3.5046600+0.0
6.80	3.6045100+0.0	3.6045100+0.0	3.6045100+0.0	3.6045100+0.0	3.6045100+0.0
6.90	3.7053700+0.0	3.7053700+0.0	3.7053700+0.0	3.7053700+0.0	3.7053700+0.0
7.00	3.8062400+0.0	3.8062400+0.0	3.8062400+0.0	3.8062400+0.0	3.8062400+0.0
7.10	3.9071200+0.0	3.9071200+0.0	3.9071200+0.0	3.9071200+0.0	3.9071200+0.0
7.20	4.0080100+0.0	4.0080100+0.0	4.0080100+0.0	4.0080100+0.0	4.0080100+0.0
7.30	4.1089100+0.0	4.1089100+0.0	4.1089100+0.0	4.1089100+0.0	4.1089100+0.0
7.40	4.2098200+0.0	4.2098200+0.0	4.2098200+0.0	4.2098200+0.0	4.2098200+0.0
7.50	4.3107400+0.0	4.3107400+0.0	4.3107400+0.0	4.3107400+0.0	4.3107400+0.0
7.60	4.4116700+0.0	4.4116700+0.0	4.4116700+0.0	4.4116700+0.0	4.4116700+0.0
7.70	4.5126100+0.0	4.5126100+0.0	4.5126100+0.0	4.5126100+0.0	4.5126100+0.0
7.80	4.6135600+0.0	4.6135600+0.0	4.6135600+0.0	4.6135600+0.0	4.6135600+0.0
7.90	4.7145200+0.0	4.7145200+0.0	4.7145200+0.0	4.7145200+0.0	4.7145200+0.0
8.00	4.8155000+0.0	4.8155000+0.0	4.8155000+0.0	4.8155000+0.0	4.8155000+0.0
8.10	4.9164900+0.0	4.9164900+0.0	4.9164900+0.0	4.9164900+0.0	4.9164900+0.0
8.20	5.0174900+0.0	5.0174900+0.0	5.0174900+0.0	5.0174900+0.0	5.0174900+0.0
8.30	5.1185000+0.0	5.1185000+0.0	5.1185000+0.0	5.1185000+0.0	5.1185000+0.0
8.40	5.2195200+0.0	5.2195200+0.0	5.2195200+0.0	5.2195200+0.0	5.2195200+0.0
8.50	5.3205500+0.0	5.3205500+0.0	5.3205500+0.0	5.3205500+0.0	5.3205500+0.0
8.60	5.4215900+0.0	5.4215900+0.0	5.4215900+0.0	5.4215900+0.0	5.4215900+0.0
8.70	5.5226400+0.0	5.5226400+0.0	5.5226400+0.0	5.5226400+0.0	5.5226400+0.0
8.80	5.6237000+0.0	5.6237000+0.0	5.6237000+0.0	5.6237000+0.0	5.6237000+0.0
8.90	5.7247700+0.0	5.7247700+0.0	5.7247700+0.0	5.7247700+0.0	5.7247700+0.0
9.00	5.8258500+0.0	5.8258500+0.0	5.8258500+0.0	5.8258500+0.0	5.8258500+0.0
9.10	5.9269400+0.0	5.9269400+0.0	5.9269400+0.0	5.9269400+0.0	5.9269400+0.0
9.20	6.0280400+0.0	6.0280400+0.0	6.0280400+0.0	6.0280400+0.0	6.0280400+0.0
9.30	6.1291500+0.0	6.1291500+0.0	6.1291500+0.0	6.1291500+0.0	6.1291500+0.0
9.40	6.2302700+0.0	6.2302700+0.0	6.2302700+0.0	6.2302700+0.0	6.2302700+0.0
9.50	6.3314000+0.0	6.3314000+0.0	6.3314000+0.0	6.3314000+0.0	6.3314000+0.0
9.60	6.4325400+0.0	6.4325400+0.0	6.4325400+0.0	6.4325400+0.0	6.4325400+0.0
9.70	6.5336900+0.0	6.5336900+0.0	6.5336900+0.0	6.5336900+0.0	6.5336900+0.0
9.80	6.6348500+0.0	6.6348500+0.0	6.6348500+0.0	6.6348500+0.0	6.6348500+0.0
9.90	6.7360200+0.0	6.7360200+0.0	6.7360200+0.0	6.7360200+0.0	6.7360200+0.0
10.00	6.8372000+0.0	6.8372000+0.0	6.8372000+0.0	6.8372000+0.0	6.8372000+0.0
10.10	6.9383900+0.0	6.9383900+0.0	6.9383900+0.0	6.9383900+0.0	6.9383900+0.0
10.20	7.0395900+0.0	7.0395900+0.0	7.0395900+0.0	7.0395900+0.0	7.0395900+0.0
10.30	7.1408000+0.0	7.1408000+0.0	7.1408000+0.0	7.1408000+0.0	7.1408000+0.0
10.40	7.2420200+0.0	7.2420200+0.0	7.2420200+0.0	7.2420200+0.0	7.2420200+0.0
10.50	7.3432500+0.0	7.3432500+0.0	7.3432500+0.0	7.3432500+0.0	7.3432500+0.0
10.60	7.4444900+0.0	7.4444900+0.0	7.4444900+0.0	7.4444900+0.0	7.4444900+0.0
10.70	7.5457400+0.0	7.5457400+0.0	7.5457400+0.0	7.5457400+0.0	7.5457400+0.0
10.80	7.6470000+0.0	7.6470000+0.0	7.6470000+0.0	7.6470000+0.0	7.6470000+0.0
10.90	7.7482700+0.0	7.7482700+0.0	7.7482700+0.0	7.7482700+0.0	7.7482700+0.0
11.00	7.8495500+0.0	7.8495500+0.0	7.8495500+0.0	7.8495500+0.0	7.8495500+0.0
11.10	7.9508400+0.0	7.9508400+0.0	7.9508400+0.0	7.9508400+0.0	7.9508400+0.0
11.20	8.0521400+0.0	8.0521400+0.0	8.0521400+0.0	8.0521400+0.0	8.0521400+0.0
11.30	8.1534500+0.0	8.1534500+0.0	8.1534500+0.0	8.1534500+0.0	8.1534500+0.0
11.40	8.2547700+0.0	8.2547700+0.0	8.2547700+0.0	8.2547700+0.0	8.2547700+0.0
11.50	8.3561000+0.0	8.3561000+0.0	8.3561000+0.0	8.3561000+0.0	8.3561000+0.0
11.60	8.4574400+0.0	8.4574400+0.0	8.4574400+0.0	8.4574400+0.0	8.4574400+0.0
11.70	8.5587900+0.0	8.5587900+0.0	8.5587900+0.0	8.5587900+0.0	8.5587900+0.0
11.80	8.6601400+0.0	8.6601400+0.0	8.6601400+0.0	8.6601400+0.0	8.6601400+0.0
11.90	8.7615000+0.0	8.7615000+0.0	8.7615000+0.0	8.7615000+0.0	8.7615000+0.0
12.00	8.8628600+0.0	8.8628600+0.0	8.8628600+0.0	8.8628600+0.0	8.8628600+0.0
12.10	8.9642200+0.0	8.9642200+0.0	8.9642200+0.0	8.9642200+0.0	8.9642200+0.0
12.20	9.0656000+0.0	9.0656000+0.0	9.0656000+0.0	9.0656000+0.0	9.0656000+0.0
12.30	9.1669900+0.0	9.1669900+0.0	9.1669900+0.0	9.1669900+0.0	9.1669900+0.0
12.40	9.268390				

Table 7b

LEAD

Atomic Collisions and Pair Productions

E	P	DE/DX-TOT	RANGE	COLLISION	PAIR PROD	SCATTERING	DE/DX-PARTIAL	NUCLEAR
(GeV/c)		(cm)	(cm)	(cm)	(cm)	(cm)	(cm)	
2.50E+01	1.42E+01	1.34E+04	1.61E+03	5.30E+01	1.42E+01	2.03E+02	4.69E+02	1.7E+02
2.70E+01	1.53E+01	1.94E+04	1.74E+03	5.70E+01	1.43E+01	2.71E+02	6.24E+02	1.9E+02
2.90E+01	1.45E+01	2.13E+04	1.86E+03	6.10E+01	1.44E+01	3.42E+02	6.98E+02	2.1E+02
3.10E+01	1.40E+01	2.06E+04	1.99E+03	6.50E+01	1.45E+01	4.13E+02	7.70E+02	2.1E+02
3.30E+01	1.37E+01	2.39E+04	2.10E+03	6.90E+01	1.46E+01	4.84E+02	8.43E+02	2.3E+02
3.50E+01	1.45E+01	2.53E+04	2.22E+03	7.23E+01	1.47E+01	5.56E+02	9.13E+02	2.4E+02
3.70E+01	1.49E+01	2.67E+04	2.34E+03	7.67E+01	1.48E+01	6.28E+02	9.83E+02	2.6E+02
4.00E+01	1.59E+01	2.89E+04	2.57E+03	8.08E+01	1.49E+01	6.90E+02	1.05E+03	2.7E+02
4.50E+01	1.61E+01	2.93E+04	2.68E+03	8.44E+01	1.49E+01	8.00E+02	1.12E+03	3.0E+02
4.70E+01	1.61E+01	3.07E+04	2.86E+03	8.82E+01	1.51E+01	9.72E+02	1.19E+03	3.2E+02
5.00E+01	1.61E+01	3.20E+04	2.96E+03	9.20E+01	1.51E+01	1.03E+03	1.26E+03	3.3E+02
5.50E+01	1.63E+01	3.33E+04	3.06E+03	9.56E+01	1.51E+01	1.12E+03	1.31E+03	3.5E+02
6.00E+01	1.65E+01	3.46E+04	3.13E+03	9.90E+01	1.52E+01	1.32E+03	1.37E+03	3.6E+02
6.50E+01	1.65E+01	3.59E+04	3.21E+03	1.03E+02	1.52E+01	1.32E+03	1.43E+03	3.6E+02
7.00E+01	1.69E+01	3.91E+04	3.47E+03	1.13E+02	1.54E+01	1.54E+03	1.57E+03	4.0E+02
7.50E+01	1.70E+01	4.24E+04	3.76E+03	1.23E+02	1.55E+01	1.65E+03	1.70E+03	4.3E+02
8.00E+01	1.71E+01	4.56E+04	3.97E+03	1.34E+02	1.55E+01	1.74E+03	1.83E+03	4.7E+02
8.50E+01	1.71E+01	4.87E+04	4.22E+03	1.44E+02	1.57E+01	1.84E+03	1.96E+03	5.1E+02
9.00E+01	1.71E+01	5.18E+04	4.50E+03	1.49E+02	1.58E+01	1.97E+03	2.09E+03	5.5E+02
9.50E+01	1.71E+01	5.49E+04	4.79E+03	1.53E+02	1.58E+01	2.10E+03	2.23E+03	5.9E+02
1.00E+02	1.71E+01	5.80E+04	5.09E+03	1.58E+02	1.59E+01	2.13E+03	2.36E+03	6.3E+02
1.05E+02	1.71E+01	6.11E+04	5.39E+03	1.63E+02	1.60E+01	2.16E+03	2.49E+03	6.6E+02
1.10E+02	1.71E+01	6.41E+04	5.69E+03	1.68E+02	1.61E+01	2.19E+03	2.62E+03	6.9E+02
1.15E+02	1.71E+01	6.72E+04	5.99E+03	1.73E+02	1.62E+01	2.22E+03	2.75E+03	7.3E+02
1.20E+02	1.72E+01	7.12E+04	6.29E+03	1.78E+02	1.63E+01	2.25E+03	2.88E+03	7.7E+02
1.25E+02	1.72E+01	7.53E+04	6.59E+03	1.83E+02	1.64E+01	2.28E+03	3.01E+03	8.1E+02
1.30E+02	1.72E+01	7.94E+04	6.89E+03	1.88E+02	1.65E+01	2.31E+03	3.14E+03	8.5E+02
1.35E+02	1.72E+01	8.35E+04	7.19E+03	1.93E+02	1.66E+01	2.34E+03	3.27E+03	8.9E+02
1.40E+02	1.72E+01	8.76E+04	7.49E+03	1.98E+02	1.67E+01	2.37E+03	3.40E+03	9.3E+02
1.45E+02	1.72E+01	9.17E+04	7.79E+03	2.03E+02	1.68E+01	2.40E+03	3.53E+03	9.7E+02
1.50E+02	1.72E+01	9.58E+04	8.09E+03	2.08E+02	1.69E+01	2.43E+03	3.66E+03	1.01E+03
1.55E+02	1.72E+01	1.02E+05	8.39E+03	2.13E+02	1.70E+01	2.46E+03	3.79E+03	1.05E+03
1.60E+02	1.72E+01	1.08E+05	8.69E+03	2.18E+02	1.71E+01	2.49E+03	3.92E+03	1.09E+03
1.65E+02	1.72E+01	1.14E+05	9.00E+03	2.23E+02	1.72E+01	2.52E+03	4.05E+03	1.13E+03
1.70E+02	1.72E+01	1.20E+05	9.30E+03	2.28E+02	1.73E+01	2.55E+03	4.18E+03	1.17E+03
1.75E+02	1.72E+01	1.26E+05	9.60E+03	2.33E+02	1.74E+01	2.58E+03	4.31E+03	1.21E+03
1.80E+02	1.72E+01	1.32E+05	9.90E+03	2.38E+02	1.75E+01	2.61E+03	4.44E+03	1.25E+03
1.85E+02	1.72E+01	1.38E+05	1.02E+04	2.43E+02	1.76E+01	2.64E+03	4.57E+03	1.29E+03
1.90E+02	1.72E+01	1.44E+05	1.07E+04	2.48E+02	1.77E+01	2.67E+03	4.70E+03	1.33E+03
1.95E+02	1.72E+01	1.50E+05	1.12E+04	2.53E+02	1.78E+01	2.70E+03	4.83E+03	1.37E+03
2.00E+02	1.72E+01	1.56E+05	1.17E+04	2.58E+02	1.79E+01	2.73E+03	4.96E+03	1.41E+03
2.05E+02	1.72E+01	1.62E+05	1.22E+04	2.63E+02	1.80E+01	2.76E+03	5.09E+03	1.45E+03
2.10E+02	1.72E+01	1.68E+05	1.27E+04	2.68E+02	1.81E+01	2.79E+03	5.22E+03	1.49E+03
2.15E+02	1.72E+01	1.74E+05	1.32E+04	2.73E+02	1.82E+01	2.82E+03	5.35E+03	1.53E+03
2.20E+02	1.72E+01	1.80E+05	1.37E+04	2.78E+02	1.83E+01	2.85E+03	5.48E+03	1.57E+03
2.25E+02	1.72E+01	1.86E+05	1.42E+04	2.83E+02	1.84E+01	2.88E+03	5.61E+03	1.61E+03
2.30E+02	1.72E+01	1.92E+05	1.47E+04	2.88E+02	1.85E+01	2.91E+03	5.74E+03	1.65E+03
2.35E+02	1.72E+01	1.98E+05	1.52E+04	2.93E+02	1.86E+01	2.94E+03	5.87E+03	1.69E+03
2.40E+02	1.72E+01	2.04E+05	1.57E+04	2.98E+02	1.87E+01	2.97E+03	6.00E+03	1.73E+03
2.45E+02	1.72E+01	2.10E+05	1.62E+04	3.03E+02	1.88E+01	3.00E+03	6.13E+03	1.77E+03
2.50E+02	1.72E+01	2.16E+05	1.67E+04	3.08E+02	1.89E+01	3.03E+03	6.26E+03	1.81E+03
2.55E+02	1.72E+01	2.22E+05	1.72E+04	3.13E+02	1.90E+01	3.06E+03	6.39E+03	1.85E+03
2.60E+02	1.72E+01	2.28E+05	1.77E+04	3.18E+02	1.91E+01	3.09E+03	6.52E+03	1.89E+03
2.65E+02	1.72E+01	2.34E+05	1.82E+04	3.23E+02	1.92E+01	3.12E+03	6.65E+03	1.93E+03
2.70E+02	1.72E+01	2.40E+05	1.87E+04	3.28E+02	1.93E+01	3.15E+03	6.78E+03	1.97E+03
2.75E+02	1.72E+01	2.46E+05	1.92E+04	3.33E+02	1.94E+01	3.18E+03	6.91E+03	2.01E+03
2.80E+02	1.72E+01	2.52E+05	1.97E+04	3.38E+02	1.95E+01	3.21E+03	7.04E+03	2.05E+03
2.85E+02	1.72E+01	2.58E+05	2.02E+04	3.43E+02	1.96E+01	3.24E+03	7.17E+03	2.09E+03
2.90E+02	1.72E+01	2.64E+05	2.07E+04	3.48E+02	1.97E+01	3.27E+03	7.30E+03	2.13E+03
2.95E+02	1.72E+01	2.70E+05	2.12E+04	3.53E+02	1.98E+01	3.30E+03	7.43E+03	2.17E+03
3.00E+02	1.72E+01	2.76E+05	2.17E+04	3.58E+02	1.99E+01	3.33E+03	7.56E+03	2.21E+03
3.05E+02	1.72E+01	2.82E+05	2.22E+04	3.63E+02	2.00E+01	3.36E+03	7.69E+03	2.25E+03
3.10E+02	1.72E+01	2.88E+05	2.27E+04	3.68E+02	2.01E+01	3.39E+03	7.82E+03	2.29E+03
3.15E+02	1.72E+01	2.94E+05	2.32E+04	3.73E+02	2.02E+01	3.42E+03	7.95E+03	2.33E+03
3.20E+02	1.72E+01	3.00E+05	2.37E+04	3.78E+02	2.03E+01	3.45E+03	8.08E+03	2.37E+03
3.25E+02	1.72E+01	3.06E+05	2.42E+04	3.83E+02	2.04E+01	3.48E+03	8.21E+03	2.41E+03
3.30E+02	1.72E+01	3.12E+05	2.47E+04	3.88E+02	2.05E+01	3.51E+03	8.34E+03	2.45E+03
3.35E+02	1.72E+01	3.18E+05	2.52E+04	3.93E+02	2.06E+01	3.54E+03	8.47E+03	2.49E+03
3.40E+02	1.72E+01	3.24E+05	2.57E+04	3.98E+02	2.07E+01	3.57E+03	8.60E+03	2.53E+03
3.45E+02	1.72E+01	3.30E+05	2.62E+04	4.03E+02	2.08E+01	3.60E+03	8.73E+03	2.57E+03
3.50E+02	1.72E+01	3.36E+05	2.67E+04	4.08E+02	2.09E+01	3.63E+03	8.86E+03	2.61E+03
3.55E+02	1.72E+01	3.42E+05	2.72E+04	4.13E+02	2.10E+01	3.66E+03	9.00E+03	2.65E+03
3.60E+02	1.72E+01	3.48E+05	2.77E+04	4.18E+02	2.11E+01	3.69E+03	9.13E+03	2.69E+03
3.65E+02	1.72E+01	3.54E+05	2.82E+04	4.23E+02	2.12E+01	3.72E+03	9.26E+03	2.73E+03
3.70E+02	1.72E+01	3.60E+05	2.87E+04	4.28E+02	2.13E+01	3.75E+03	9.40E+03	2.77E+03
3.75E+02	1.72E+01	3.66E+05	2.92E+04	4.33E+02	2.14E+01	3.78E+03	9.53E+03	2.81E+03
3.80E+02	1.72E+01	3.72E+05	2.97E+04	4.38E+02	2.15E+01	3.81E+03	9.66E+03	2.85E+03
3.85E+02	1.72E+01	3.78E+05	3.02E+04	4.43E+02	2.16E+01	3.84E+03	9.80E+03	2.89E+03
3.90E+02	1.72E+01	3.84E+05	3.07E+04	4.48E+02	2.17E+01	3.87E+03	9.93E+03	2.93E+03
3.95E+02	1.72E+01	3.90E+05	3.12E+04	4.53E+02	2.18E+01	3.90E+03	1.007E+04	2.97E+03
4.00E+02	1.72E+01	3.96E+05	3.17E+04	4.58E+02	2.19E+01	3.93E+03	1.020E+04	3.01E+03
4.05E+02	1.72E+01	4.02E+05	3.22E+04	4.63E+02	2.20E+01	3.96E+03	1.033E+04	3.05E+03
4.10E+02	1.72E+01	4.08E+05	3.27E+04	4.68E+02	2.21E+01	3.99E+03	1.046E+04	3.09E+03
4.15E+02	1.72E+01	4.14E+05	3.32E+04	4.73E+02	2.22E+01	4.02E+03	1.059E+04	3.13E+03
4.20E+02	1.72E+01	4.20E+05	3.37E+04	4.78E+02	2.23E+01	4.05E+03	1.072E+04	3.17E+03
4.25E+02	1.72E+01	4.26E+05	3.42E+04	4.83E+02	2.24E+01	4.08E+03	1.085E+04	3.21E+03
4.30E+02	1.72E+01	4.32E+05	3.47E+04	4.88E+02	2.25E+01	4.11E+03	1.098E+04	3.25E+03
4.35E+02	1.72E+01	4.38E+05	3.52E+04	4.93E+02	2.26E+01	4.14E+03	1.111E+04	3.29E+03
4.40E+02	1.72E+01	4.44E+05	3.57E+04	4.98E+02	2.27E+01	4.17E+03	1.124E+04	3.33E+03
4.45E+02	1.72E+01	4.50E+05	3.62E+04	5.03E+02				

Table 7c

LEAD
Atomic Collisions and Pair Productions

P. (GeV)	DE/DX-TOT		RANGE (cm)	(F.I.)	COLLISION ALL IN MEV IN CM/CHS01	PAIR PROD IN MEV IN CM/CHS01	BSEMITRAL IN MEV IN CM/CHS01	NUCLEAR
	(GeV/C)	(GeV/C)SQ						
90.0E+02	.9911E+01	.4588E+05	.4013E+04	.1322E+03	.1900E+01	.6032E+00	.5659E+00	.6575E+01
90.5E+02	.9911E+01	.4588E+05	.4133E+04	.1378E+03	.1916E+01	.6475E+00	.5933E+00	.6933E+01
100.0E+02	.9911E+01	.4588E+05	.4133E+04	.1433E+03	.1814E+01	.6750E+00	.5295E+00	.7300E+01
110.0E+02	.9911E+01	.4588E+05	.4133E+04	.1496E+03	.1520E+01	.7133E+00	.5650E+00	.7560E+01
120.0E+02	.9911E+01	.4588E+05	.4133E+04	.1550E+03	.1822E+01	.7500E+00	.7035E+00	.8035E+01
130.0E+02	.9911E+01	.4588E+05	.4133E+04	.1600E+03	.1822E+01	.7874E+00	.7774E+00	.8774E+01
140.0E+02	.9911E+01	.4588E+05	.4133E+04	.1661E+03	.1832E+01	.8247E+00	.8115E+00	.9115E+01
150.0E+02	.9911E+01	.4588E+05	.4133E+04	.1711E+03	.1931E+01	.8613E+00	.8929E+00	.9429E+01
160.0E+02	.9911E+01	.4588E+05	.4133E+04	.1772E+03	.1936E+01	.8969E+00	.9345E+00	.9845E+01
170.0E+02	.9911E+01	.4588E+05	.4133E+04	.1822E+03	.1936E+01	.9356E+00	.9740E+00	.1020E+02
180.0E+02	.9911E+01	.4588E+05	.4133E+04	.1872E+03	.1944E+01	.9740E+00	.1010E+01	.1070E+00
190.0E+02	.9911E+01	.4588E+05	.4133E+04	.1922E+03	.1944E+01	.1015E+01	.1055E+01	.1115E+01
200.0E+02	.9911E+01	.4588E+05	.4133E+04	.1972E+03	.1844E+01	.1055E+01	.1195E+01	.1255E+01
210.0E+02	.9911E+01	.4588E+05	.4133E+04	.2022E+03	.1844E+01	.1129E+01	.1229E+01	.1329E+01
220.0E+02	.9911E+01	.4588E+05	.4133E+04	.2072E+03	.1844E+01	.1185E+01	.1325E+01	.1425E+01
230.0E+02	.9911E+01	.4588E+05	.4133E+04	.2122E+03	.1845E+01	.1240E+01	.1420E+01	.1520E+01
240.0E+02	.9911E+01	.4588E+05	.4133E+04	.2172E+03	.1845E+01	.1295E+01	.1495E+01	.1695E+01
250.0E+02	.9911E+01	.4588E+05	.4133E+04	.2222E+03	.1845E+01	.1350E+01	.1550E+01	.1750E+01
260.0E+02	.9911E+01	.4588E+05	.4133E+04	.2272E+03	.1845E+01	.1405E+01	.1605E+01	.1805E+01
270.0E+02	.9911E+01	.4588E+05	.4133E+04	.2322E+03	.1845E+01	.1460E+01	.1760E+01	.1960E+01
280.0E+02	.9911E+01	.4588E+05	.4133E+04	.2372E+03	.1845E+01	.1515E+01	.1865E+01	.2065E+01
290.0E+02	.9911E+01	.4588E+05	.4133E+04	.2422E+03	.1845E+01	.1570E+01	.1965E+01	.2165E+01
300.0E+02	.9911E+01	.4588E+05	.4133E+04	.2472E+03	.1845E+01	.1625E+01	.2065E+01	.2265E+01
310.0E+02	.9911E+01	.4588E+05	.4133E+04	.2522E+03	.1845E+01	.1680E+01	.2120E+01	.2320E+01
320.0E+02	.9911E+01	.4588E+05	.4133E+04	.2572E+03	.1845E+01	.1735E+01	.2175E+01	.2425E+01
330.0E+02	.9911E+01	.4588E+05	.4133E+04	.2622E+03	.1845E+01	.1790E+01	.2225E+01	.2525E+01
340.0E+02	.9911E+01	.4588E+05	.4133E+04	.2672E+03	.1845E+01	.1845E+01	.2275E+01	.2625E+01
350.0E+02	.9911E+01	.4588E+05	.4133E+04	.2722E+03	.1845E+01	.1900E+01	.2325E+01	.2725E+01
360.0E+02	.9911E+01	.4588E+05	.4133E+04	.2772E+03	.1845E+01	.1955E+01	.2375E+01	.2825E+01
370.0E+02	.9911E+01	.4588E+05	.4133E+04	.2822E+03	.1845E+01	.2010E+01	.2425E+01	.2925E+01
380.0E+02	.9911E+01	.4588E+05	.4133E+04	.2872E+03	.1845E+01	.2065E+01	.2475E+01	.3025E+01
390.0E+02	.9911E+01	.4588E+05	.4133E+04	.2922E+03	.1845E+01	.2120E+01	.2525E+01	.3125E+01
400.0E+02	.9911E+01	.4588E+05	.4133E+04	.2972E+03	.1845E+01	.2175E+01	.2575E+01	.3225E+01
410.0E+02	.9911E+01	.4588E+05	.4133E+04	.3022E+03	.1845E+01	.2230E+01	.2625E+01	.3325E+01
420.0E+02	.9911E+01	.4588E+05	.4133E+04	.3072E+03	.1845E+01	.2285E+01	.2675E+01	.3425E+01
430.0E+02	.9911E+01	.4588E+05	.4133E+04	.3122E+03	.1845E+01	.2340E+01	.2725E+01	.3525E+01
440.0E+02	.9911E+01	.4588E+05	.4133E+04	.3172E+03	.1845E+01	.2395E+01	.2775E+01	.3625E+01
450.0E+02	.9911E+01	.4588E+05	.4133E+04	.3222E+03	.1845E+01	.2450E+01	.2825E+01	.3725E+01
460.0E+02	.9911E+01	.4588E+05	.4133E+04	.3272E+03	.1845E+01	.2505E+01	.2875E+01	.3825E+01
470.0E+02	.9911E+01	.4588E+05	.4133E+04	.3322E+03	.1845E+01	.2560E+01	.2925E+01	.3925E+01
480.0E+02	.9911E+01	.4588E+05	.4133E+04	.3372E+03	.1845E+01	.2615E+01	.2975E+01	.4025E+01
490.0E+02	.9911E+01	.4588E+05	.4133E+04	.3422E+03	.1845E+01	.2670E+01	.3025E+01	.4125E+01
500.0E+02	.9911E+01	.4588E+05	.4133E+04	.3472E+03	.1845E+01	.2725E+01	.3075E+01	.4225E+01
510.0E+02	.9911E+01	.4588E+05	.4133E+04	.3522E+03	.1845E+01	.2780E+01	.3125E+01	.4325E+01
520.0E+02	.9911E+01	.4588E+05	.4133E+04	.3572E+03	.1845E+01	.2835E+01	.3175E+01	.4425E+01
530.0E+02	.9911E+01	.4588E+05	.4133E+04	.3622E+03	.1845E+01	.2890E+01	.3225E+01	.4525E+01
540.0E+02	.9911E+01	.4588E+05	.4133E+04	.3672E+03	.1845E+01	.2945E+01	.3275E+01	.4625E+01
550.0E+02	.9911E+01	.4588E+05	.4133E+04	.3722E+03	.1845E+01	.3000E+01	.3325E+01	.4725E+01
560.0E+02	.9911E+01	.4588E+05	.4133E+04	.3772E+03	.1845E+01	.3055E+01	.3375E+01	.4825E+01
570.0E+02	.9911E+01	.4588E+05	.4133E+04	.3822E+03	.1845E+01	.3110E+01	.3425E+01	.4925E+01
580.0E+02	.9911E+01	.4588E+05	.4133E+04	.3872E+03	.1845E+01	.3165E+01	.3475E+01	.5025E+01
590.0E+02	.9911E+01	.4588E+05	.4133E+04	.3922E+03	.1845E+01	.3220E+01	.3525E+01	.5125E+01
600.0E+02	.9911E+01	.4588E+05	.4133E+04	.3972E+03	.1845E+01	.3275E+01	.3575E+01	.5225E+01
610.0E+02	.9911E+01	.4588E+05	.4133E+04	.4022E+03	.1845E+01	.3330E+01	.3625E+01	.5325E+01
620.0E+02	.9911E+01	.4588E+05	.4133E+04	.4072E+03	.1845E+01	.3385E+01	.3675E+01	.5425E+01
630.0E+02	.9911E+01	.4588E+05	.4133E+04	.4122E+03	.1845E+01	.3440E+01	.3725E+01	.5525E+01
640.0E+02	.9911E+01	.4588E+05	.4133E+04	.4172E+03	.1845E+01	.3495E+01	.3775E+01	.5625E+01
650.0E+02	.9911E+01	.4588E+05	.4133E+04	.4222E+03	.1845E+01	.3550E+01	.3825E+01	.5725E+01
660.0E+02	.9911E+01	.4588E+05	.4133E+04	.4272E+03	.1845E+01	.3605E+01	.3875E+01	.5825E+01
670.0E+02	.9911E+01	.4588E+05	.4133E+04	.4322E+03	.1845E+01	.3660E+01	.3925E+01	.5925E+01
680.0E+02	.9911E+01	.4588E+05	.4133E+04	.4372E+03	.1845E+01	.3715E+01	.3975E+01	.6025E+01
690.0E+02	.9911E+01	.4588E+05	.4133E+04	.4422E+03	.1845E+01	.3770E+01	.4025E+01	.6125E+01
700.0E+02	.9911E+01	.4588E+05	.4133E+04	.4472E+03	.1845E+01	.3825E+01	.4075E+01	.6225E+01
710.0E+02	.9911E+01	.4588E+05	.4133E+04	.4522E+03	.1845E+01	.3880E+01	.4125E+01	.6325E+01
720.0E+02	.9911E+01	.4588E+05	.4133E+04	.4572E+03	.1845E+01	.3935E+01	.4175E+01	.6425E+01
730.0E+02	.9911E+01	.4588E+05	.4133E+04	.4622E+03	.1845E+01	.3990E+01	.4225E+01	.6525E+01
740.0E+02	.9911E+01	.4588E+05	.4133E+04	.4672E+03	.1845E+01	.4045E+01	.4275E+01	.6625E+01
750.0E+02	.9911E+01	.4588E+05	.4133E+04	.4722E+03	.1845E+01	.4100E+01	.4325E+01	.6725E+01
760.0E+02	.9911E+01	.4588E+05	.4133E+04	.4772E+03	.1845E+01	.4155E+01	.4375E+01	.6825E+01
770.0E+02	.9911E+01	.4588E+05	.4133E+04	.4822E+03	.1845E+01	.4210E+01	.4425E+01	.6925E+01
780.0E+02	.9911E+01	.4588E+05	.4133E+04	.4872E+03	.1845E+01	.4265E+01	.4475E+01	.7025E+01
790.0E+02	.9911E+01	.4588E+05	.4133E+04	.4922E+03	.1845E+01	.4320E+01	.4525E+01	.7125E+01
800.0E+02	.9911E+01	.4588E+05	.4133E+04	.4972E+03	.1845E+01	.4375E+01	.4575E+01	.7225E+01
810.0E+02	.9911E+01	.4588E+05	.4133E+04	.5022E+03	.1845E+01	.4430E+01	.4625E+01	.7325E+01
820.0E+02	.9911E+01	.4588E+05	.4133E+04	.5072E+03	.1845E+01	.4485E+01	.4675E+01	.7425E+01
830.0E+02	.9911E+01	.4588E+05	.4133E+04	.5122E+03	.1845E+01	.4540E+01	.4725E+01	.7525E+01
840.0E+02	.9911E+01	.4588E+05	.4133E+04	.5172E+03	.1845E+01	.4595E+01	.4775E+01	.7625E+01
850.0E+02	.9911E+01	.4588E+05	.4133E+04	.5222E+03	.1845E+01	.4650E+01	.4825E+01	.7725E+01
860.0E+02	.9911E+01	.4588E+05	.4133E+04	.5272E+03	.1845E+01	.4705E+01	.4875E+01	.7825E+01
870.0E+02	.9911E+01	.4588E+05	.4133E+04	.5322E+03	.1845E+01	.4760E+01	.4925E+01	.7925E+01
880.0E+02	.9911E+01	.4588E+05	.4133E+04	.5372E+03	.1845E+01	.4815E+01	.4975E+01	.8025E+01
890.0E+02	.9911E+01	.4588E+05	.4133E+04	.5422E+03	.1845E+01	.4870E+01	.5025E+01	.8125E+01
900.0E+02	.9911E+01	.4588E+05	.4133E+04	.5472E+03	.1845E+01	.4925E+01	.5075E+01	.8225E+01
910.0E+02	.9911E+01	.4588E+05	.4133E+04	.5522E+03	.1845E+01	.4980E+01	.5125E+01	.8325E+01
920.0E+02	.9911E+01	.4588E+05	.4133E+04	.5572E+03	.1845E+01	.5035E+01	.5175E+01	.8425E+01
930.0E+02	.9911E+01	.4588E+05	.4133E+04	.5622E+03	.1845E+01	.5090E+01	.5225E+01	.8525E+01
940.0E+02	.9911E+01	.4588E+05	.4133E+04	.5672E+03	.1845E+01	.5145E+01	.5275E+01	.8625E+01
950.0E+02	.9911E							

Table 7d

LEAD
Atomic Collisions and Pair Productions

P EV	D _E /DX-TOT CHEV/CHMSA	(GM/CHMSA)	RANGE		COLLISION (ALL)	PAIR PAIR/PAIR MEV/GM/CHMSA)	DF/DX-PARTIAL NUCLEAR
			(CM)	(CM)			
5.2	5.2E+01	5.2E+01	1.6E+01	1.6E+01	1.92E+01	4.60E+01	4.27E+00
5.4	5.4E+01	5.4E+01	1.72E+01	1.72E+01	1.93E+01	4.58E+01	4.35E+00
5.6	5.6E+01	5.6E+01	1.76E+01	1.76E+01	1.93E+01	4.52E+01	4.52E+00
5.8	5.8E+01	5.8E+01	1.79E+01	1.79E+01	1.93E+01	4.47E+01	4.72E+00
6.0	6.0E+01	6.0E+01	1.82E+01	1.82E+01	1.93E+01	4.42E+01	4.92E+00
6.2	6.2E+01	6.2E+01	1.85E+01	1.85E+01	1.93E+01	4.38E+01	5.12E+00
6.4	6.4E+01	6.4E+01	1.88E+01	1.88E+01	1.93E+01	4.35E+01	5.32E+00
6.6	6.6E+01	6.6E+01	1.91E+01	1.91E+01	1.93E+01	4.32E+01	5.52E+00
6.8	6.8E+01	6.8E+01	1.94E+01	1.94E+01	1.93E+01	4.29E+01	5.72E+00
7.0	7.0E+01	7.0E+01	1.97E+01	1.97E+01	1.93E+01	4.26E+01	5.92E+00
7.2	7.2E+01	7.2E+01	2.00E+01	2.00E+01	1.93E+01	4.23E+01	6.12E+00
7.4	7.4E+01	7.4E+01	2.03E+01	2.03E+01	1.93E+01	4.20E+01	6.32E+00
7.6	7.6E+01	7.6E+01	2.06E+01	2.06E+01	1.93E+01	4.17E+01	6.52E+00
7.8	7.8E+01	7.8E+01	2.09E+01	2.09E+01	1.93E+01	4.14E+01	6.72E+00
8.0	8.0E+01	8.0E+01	2.12E+01	2.12E+01	1.93E+01	4.11E+01	6.92E+00
8.2	8.2E+01	8.2E+01	2.15E+01	2.15E+01	1.93E+01	4.08E+01	7.12E+00
8.4	8.4E+01	8.4E+01	2.18E+01	2.18E+01	1.93E+01	4.05E+01	7.32E+00
8.6	8.6E+01	8.6E+01	2.21E+01	2.21E+01	1.93E+01	4.02E+01	7.52E+00
8.8	8.8E+01	8.8E+01	2.24E+01	2.24E+01	1.93E+01	3.99E+01	7.72E+00
9.0	9.0E+01	9.0E+01	2.27E+01	2.27E+01	1.93E+01	3.96E+01	7.92E+00
9.2	9.2E+01	9.2E+01	2.30E+01	2.30E+01	1.93E+01	3.93E+01	8.12E+00
9.4	9.4E+01	9.4E+01	2.33E+01	2.33E+01	1.93E+01	3.90E+01	8.32E+00
9.6	9.6E+01	9.6E+01	2.36E+01	2.36E+01	1.93E+01	3.87E+01	8.52E+00
9.8	9.8E+01	9.8E+01	2.39E+01	2.39E+01	1.93E+01	3.84E+01	8.72E+00
10.0	1.00E+02	1.00E+02	2.42E+01	2.42E+01	1.93E+01	3.81E+01	8.92E+00
10.2	1.02E+02	1.02E+02	2.45E+01	2.45E+01	1.93E+01	3.78E+01	9.12E+00
10.4	1.04E+02	1.04E+02	2.48E+01	2.48E+01	1.93E+01	3.75E+01	9.32E+00
10.6	1.06E+02	1.06E+02	2.51E+01	2.51E+01	1.93E+01	3.72E+01	9.52E+00
10.8	1.08E+02	1.08E+02	2.54E+01	2.54E+01	1.93E+01	3.69E+01	9.72E+00
11.0	1.10E+02	1.10E+02	2.57E+01	2.57E+01	1.93E+01	3.66E+01	9.92E+00
11.2	1.12E+02	1.12E+02	2.60E+01	2.60E+01	1.93E+01	3.63E+01	1.012E+01
11.4	1.14E+02	1.14E+02	2.63E+01	2.63E+01	1.93E+01	3.60E+01	1.032E+01
11.6	1.16E+02	1.16E+02	2.66E+01	2.66E+01	1.93E+01	3.57E+01	1.052E+01
11.8	1.18E+02	1.18E+02	2.69E+01	2.69E+01	1.93E+01	3.54E+01	1.072E+01
12.0	1.20E+02	1.20E+02	2.72E+01	2.72E+01	1.93E+01	3.51E+01	1.092E+01
12.2	1.22E+02	1.22E+02	2.75E+01	2.75E+01	1.93E+01	3.48E+01	1.112E+01
12.4	1.24E+02	1.24E+02	2.78E+01	2.78E+01	1.93E+01	3.45E+01	1.132E+01
12.6	1.26E+02	1.26E+02	2.81E+01	2.81E+01	1.93E+01	3.42E+01	1.152E+01
12.8	1.28E+02	1.28E+02	2.84E+01	2.84E+01	1.93E+01	3.39E+01	1.172E+01
13.0	1.30E+02	1.30E+02	2.87E+01	2.87E+01	1.93E+01	3.36E+01	1.192E+01
13.2	1.32E+02	1.32E+02	2.90E+01	2.90E+01	1.93E+01	3.33E+01	1.212E+01
13.4	1.34E+02	1.34E+02	2.93E+01	2.93E+01	1.93E+01	3.30E+01	1.232E+01
13.6	1.36E+02	1.36E+02	2.96E+01	2.96E+01	1.93E+01	3.27E+01	1.252E+01
13.8	1.38E+02	1.38E+02	2.99E+01	2.99E+01	1.93E+01	3.24E+01	1.272E+01
14.0	1.40E+02	1.40E+02	3.02E+01	3.02E+01	1.93E+01	3.21E+01	1.292E+01
14.2	1.42E+02	1.42E+02	3.05E+01	3.05E+01	1.93E+01	3.18E+01	1.312E+01
14.4	1.44E+02	1.44E+02	3.08E+01	3.08E+01	1.93E+01	3.15E+01	1.332E+01
14.6	1.46E+02	1.46E+02	3.11E+01	3.11E+01	1.93E+01	3.12E+01	1.352E+01
14.8	1.48E+02	1.48E+02	3.14E+01	3.14E+01	1.93E+01	3.09E+01	1.372E+01
15.0	1.50E+02	1.50E+02	3.17E+01	3.17E+01	1.93E+01	3.06E+01	1.392E+01
15.2	1.52E+02	1.52E+02	3.20E+01	3.20E+01	1.93E+01	3.03E+01	1.412E+01
15.4	1.54E+02	1.54E+02	3.23E+01	3.23E+01	1.93E+01	3.00E+01	1.432E+01
15.6	1.56E+02	1.56E+02	3.26E+01	3.26E+01	1.93E+01	2.97E+01	1.452E+01
15.8	1.58E+02	1.58E+02	3.29E+01	3.29E+01	1.93E+01	2.94E+01	1.472E+01
16.0	1.60E+02	1.60E+02	3.32E+01	3.32E+01	1.93E+01	2.91E+01	1.492E+01
16.2	1.62E+02	1.62E+02	3.35E+01	3.35E+01	1.93E+01	2.88E+01	1.512E+01
16.4	1.64E+02	1.64E+02	3.38E+01	3.38E+01	1.93E+01	2.85E+01	1.532E+01
16.6	1.66E+02	1.66E+02	3.41E+01	3.41E+01	1.93E+01	2.82E+01	1.552E+01
16.8	1.68E+02	1.68E+02	3.44E+01	3.44E+01	1.93E+01	2.79E+01	1.572E+01
17.0	1.70E+02	1.70E+02	3.47E+01	3.47E+01	1.93E+01	2.76E+01	1.592E+01
17.2	1.72E+02	1.72E+02	3.50E+01	3.50E+01	1.93E+01	2.73E+01	1.612E+01
17.4	1.74E+02	1.74E+02	3.53E+01	3.53E+01	1.93E+01	2.70E+01	1.632E+01
17.6	1.76E+02	1.76E+02	3.56E+01	3.56E+01	1.93E+01	2.67E+01	1.652E+01
17.8	1.78E+02	1.78E+02	3.59E+01	3.59E+01	1.93E+01	2.64E+01	1.672E+01
18.0	1.80E+02	1.80E+02	3.62E+01	3.62E+01	1.93E+01	2.61E+01	1.692E+01
18.2	1.82E+02	1.82E+02	3.65E+01	3.65E+01	1.93E+01	2.58E+01	1.712E+01
18.4	1.84E+02	1.84E+02	3.68E+01	3.68E+01	1.93E+01	2.55E+01	1.732E+01
18.6	1.86E+02	1.86E+02	3.71E+01	3.71E+01	1.93E+01	2.52E+01	1.752E+01
18.8	1.88E+02	1.88E+02	3.74E+01	3.74E+01	1.93E+01	2.49E+01	1.772E+01
19.0	1.90E+02	1.90E+02	3.77E+01	3.77E+01	1.93E+01	2.46E+01	1.792E+01
19.2	1.92E+02	1.92E+02	3.80E+01	3.80E+01	1.93E+01	2.43E+01	1.812E+01
19.4	1.94E+02	1.94E+02	3.83E+01	3.83E+01	1.93E+01	2.40E+01	1.832E+01
19.6	1.96E+02	1.96E+02	3.86E+01	3.86E+01	1.93E+01	2.37E+01	1.852E+01
19.8	1.98E+02	1.98E+02	3.89E+01	3.89E+01	1.93E+01	2.34E+01	1.872E+01
20.0	2.00E+02	2.00E+02	3.92E+01	3.92E+01	1.93E+01	2.31E+01	1.892E+01
20.2	2.02E+02	2.02E+02	3.95E+01	3.95E+01	1.93E+01	2.28E+01	1.912E+01
20.4	2.04E+02	2.04E+02	3.98E+01	3.98E+01	1.93E+01	2.25E+01	1.932E+01
20.6	2.06E+02	2.06E+02	4.01E+01	4.01E+01	1.93E+01	2.22E+01	1.952E+01
20.8	2.08E+02	2.08E+02	4.04E+01	4.04E+01	1.93E+01	2.19E+01	1.972E+01
21.0	2.10E+02	2.10E+02	4.07E+01	4.07E+01	1.93E+01	2.16E+01	1.992E+01
21.2	2.12E+02	2.12E+02	4.10E+01	4.10E+01	1.93E+01	2.13E+01	2.012E+01
21.4	2.14E+02	2.14E+02	4.13E+01	4.13E+01	1.93E+01	2.10E+01	2.032E+01
21.6	2.16E+02	2.16E+02	4.16E+01	4.16E+01	1.93E+01	2.07E+01	2.052E+01
21.8	2.18E+02	2.18E+02	4.19E+01	4.19E+01	1.93E+01	2.04E+01	2.072E+01
22.0	2.20E+02	2.20E+02	4.22E+01	4.22E+01	1.93E+01	2.01E+01	2.092E+01
22.2	2.22E+02	2.22E+02	4.25E+01	4.25E+01	1.93E+01	1.98E+01	2.112E+01
22.4	2.24E+02	2.24E+02	4.28E+01	4.28E+01	1.93E+01	1.95E+01	2.132E+01
22.6	2.26E+02	2.26E+02	4.31E+01	4.31E+01	1.93E+01	1.92E+01	2.152E+01
22.8	2.28E+02	2.28E+02	4.34E+01	4.34E+01	1.93E+01	1.89E+01	2.172E+01
23.0	2.30E+02	2.30E+02	4.37E+01	4.37E+01	1.93E+01	1.86E+01	2.192E+01
23.2	2.32E+02	2.32E+02	4.40E+01	4.40E+01	1.93E+01	1.83E+01	2.212E+01
23.4	2.34E+02	2.34E+02	4.43E+01	4.43E+01	1.93E+01	1.80E+01	2.232E+01
23.6	2.36E+02	2.36E+02	4.46E+01	4.46E+01	1.93E+01	1.77E+01	2.252E+01
23.8	2.38E+02	2.38E+02	4.49E+01	4.49E+01	1.93E+01	1.74E+01	2.272E+01
24.0	2.40E+02	2.40E+02	4.52E+01	4.52E+01	1.93E+01	1.71E+01	2.292E+01
24.2	2.42E+02	2.42E+02	4.55E+01	4.55E+01	1.93E+01	1.68E+01	2.312E+01
24.4	2.44E+02	2.44E+02	4.58E+01	4.58E+01	1.93E+01	1.65E+01	2.332E+01
24.6	2.46E+02	2.46E+02	4.61E+01	4.61E+01	1.93E+01	1.62E+01	2.352E+01
24.8	2.48E+02	2.48E+02	4.64E+01	4.64E+01	1.93E+01	1.59E+01	2.372E+01
25.0	2.50E+02	2.50E+02	4.67E+01	4.67E+01	1.93E+01	1.56E+01	2.392E+01
25.2	2.52E+02	2.52E+02	4.70E+01	4.70E+01	1.93E+01	1.53E+01	2.412E+01
25.4	2.54E+02	2.54E+02	4.73E+01	4.73E+01	1.93E+01	1.50E+01	2.432E+01
25.6	2.56E+02	2					

Table 8a

URANIUM

Atomic Collisions and Pair Productions

MUON RESONANCE RANGE TABLES

$1/\lambda_C = E$	$U = 1.6125298 \times 10^{-3} \text{ CMS/GeV}$	RANGE	$\text{COLLISION (ALL IN } \mu\text{M/CM}^2)$	$\text{PAIR PRODUCTION/PAIR/ATOMIC}$	$\text{PAIR PROTON/MEV/CM}^2$	NUCLEAR
(GeV)	(GeV/CM ²)	(cm)	(ft)			
4.75E+01	3.74E+01	0.01	2.35E-02			
4.80E+01	3.77E+01	0.02	4.85E-03			
4.85E+01	3.81E+01	0.05	1.21E-02			
4.90E+01	3.85E+01	0.1	2.76E-02			
4.95E+01	3.89E+01	0.2	5.52E-02			
5.00E+01	3.93E+01	0.5	1.38E-01			
5.05E+01	3.97E+01	1.0	2.76E-01			
5.10E+01	4.01E+01	2.0	5.52E-01			
5.15E+01	4.05E+01	5.0	1.38E+00			
5.20E+01	4.09E+01	10.0	2.76E+00			
5.25E+01	4.13E+01	20.0	5.52E+00			
5.30E+01	4.17E+01	50.0	1.38E+01			
5.35E+01	4.21E+01	100.0	2.76E+01			
5.40E+01	4.25E+01	200.0	5.52E+01			
5.45E+01	4.29E+01	500.0	1.38E+02			
5.50E+01	4.33E+01	1000.0	2.76E+02			
5.55E+01	4.37E+01	2000.0	5.52E+02			
5.60E+01	4.41E+01	5000.0	1.38E+03			
5.65E+01	4.45E+01	10000.0	2.76E+03			
5.70E+01	4.49E+01	20000.0	5.52E+03			
5.75E+01	4.53E+01	50000.0	1.38E+04			
5.80E+01	4.57E+01	100000.0	2.76E+04			
5.85E+01	4.61E+01	200000.0	5.52E+04			
5.90E+01	4.65E+01	500000.0	1.38E+05			
5.95E+01	4.69E+01	1000000.0	2.76E+05			
6.00E+01	4.73E+01	2000000.0	5.52E+05			
6.05E+01	4.77E+01	5000000.0	1.38E+06			
6.10E+01	4.81E+01	10000000.0	2.76E+06			
6.15E+01	4.85E+01	20000000.0	5.52E+06			
6.20E+01	4.89E+01	50000000.0	1.38E+07			
6.25E+01	4.93E+01	100000000.0	2.76E+07			
6.30E+01	4.97E+01	200000000.0	5.52E+07			
6.35E+01	5.01E+01	500000000.0	1.38E+08			
6.40E+01	5.05E+01	1000000000.0	2.76E+08			
6.45E+01	5.09E+01	2000000000.0	5.52E+08			
6.50E+01	5.13E+01	5000000000.0	1.38E+09			
6.55E+01	5.17E+01	10000000000.0	2.76E+09			
6.60E+01	5.21E+01	20000000000.0	5.52E+09			
6.65E+01	5.25E+01	50000000000.0	1.38E+10			
6.70E+01	5.29E+01	100000000000.0	2.76E+10			
6.75E+01	5.33E+01	200000000000.0	5.52E+10			
6.80E+01	5.37E+01	500000000000.0	1.38E+11			
6.85E+01	5.41E+01	1000000000000.0	2.76E+11			
6.90E+01	5.45E+01	2000000000000.0	5.52E+11			
6.95E+01	5.49E+01	5000000000000.0	1.38E+12			
7.00E+01	5.53E+01	10000000000000.0	2.76E+12			
7.05E+01	5.57E+01	20000000000000.0	5.52E+12			
7.10E+01	5.61E+01	50000000000000.0	1.38E+13			
7.15E+01	5.65E+01	100000000000000.0	2.76E+13			
7.20E+01	5.69E+01	200000000000000.0	5.52E+13			
7.25E+01	5.73E+01	500000000000000.0	1.38E+14			
7.30E+01	5.77E+01	1000000000000000.0	2.76E+14			
7.35E+01	5.81E+01	2000000000000000.0	5.52E+14			
7.40E+01	5.85E+01	5000000000000000.0	1.38E+15			
7.45E+01	5.89E+01	10000000000000000.0	2.76E+15			
7.50E+01	5.93E+01	20000000000000000.0	5.52E+15			
7.55E+01	5.97E+01	50000000000000000.0	1.38E+16			
7.60E+01	6.01E+01	100000000000000000.0	2.76E+16			
7.65E+01	6.05E+01	200000000000000000.0	5.52E+16			
7.70E+01	6.09E+01	500000000000000000.0	1.38E+17			
7.75E+01	6.13E+01	1000000000000000000.0	2.76E+17			
7.80E+01	6.17E+01	2000000000000000000.0	5.52E+17			
7.85E+01	6.21E+01	5000000000000000000.0	1.38E+18			
7.90E+01	6.25E+01	10000000000000000000.0	2.76E+18			
7.95E+01	6.29E+01	20000000000000000000.0	5.52E+18			
8.00E+01	6.33E+01	50000000000000000000.0	1.38E+19			
8.05E+01	6.37E+01	100000000000000000000.0	2.76E+19			
8.10E+01	6.41E+01	200000000000000000000.0	5.52E+19			
8.15E+01	6.45E+01	500000000000000000000.0	1.38E+20			
8.20E+01	6.49E+01	1000000000000000000000.0	2.76E+20			
8.25E+01	6.53E+01	2000000000000000000000.0	5.52E+20			
8.30E+01	6.57E+01	5000000000000000000000.0	1.38E+21			
8.35E+01	6.61E+01	10000000000000000000000.0	2.76E+21			
8.40E+01	6.65E+01	20000000000000000000000.0	5.52E+21			
8.45E+01	6.69E+01	50000000000000000000000.0	1.38E+22			
8.50E+01	6.73E+01	10000000000000000000000.0	2.76E+22			
8.55E+01	6.77E+01	20000000000000000000000.0	5.52E+22			
8.60E+01	6.81E+01	50000000000000000000000.0	1.38E+23			
8.65E+01	6.85E+01	10000000000000000000000.0	2.76E+23			
8.70E+01	6.89E+01	20000000000000000000000.0	5.52E+23			
8.75E+01	6.93E+01	50000000000000000000000.0	1.38E+24			
8.80E+01	6.97E+01	10000000000000000000000.0	2.76E+24			
8.85E+01	7.01E+01	20000000000000000000000.0	5.52E+24			
8.90E+01	7.05E+01	50000000000000000000000.0	1.38E+25			
8.95E+01	7.09E+01	10000000000000000000000.0	2.76E+25			
9.00E+01	7.13E+01	20000000000000000000000.0	5.52E+25			
9.05E+01	7.17E+01	50000000000000000000000.0	1.38E+26			
9.10E+01	7.21E+01	10000000000000000000000.0	2.76E+26			
9.15E+01	7.25E+01	20000000000000000000000.0	5.52E+26			
9.20E+01	7.29E+01	50000000000000000000000.0	1.38E+27			
9.25E+01	7.33E+01	10000000000000000000000.0	2.76E+27			
9.30E+01	7.37E+01	20000000000000000000000.0	5.52E+27			
9.35E+01	7.41E+01	50000000000000000000000.0	1.38E+28			
9.40E+01	7.45E+01	10000000000000000000000.0	2.76E+28			
9.45E+01	7.49E+01	20000000000000000000000.0	5.52E+28			
9.50E+01	7.53E+01	50000000000000000000000.0	1.38E+29			
9.55E+01	7.57E+01	10000000000000000000000.0	2.76E+29			
9.60E+01	7.61E+01	20000000000000000000000.0	5.52E+29			
9.65E+01	7.65E+01	50000000000000000000000.0	1.38E+30			
9.70E+01	7.69E+01	10000000000000000000000.0	2.76E+30			
9.75E+01	7.73E+01	20000000000000000000000.0	5.52E+30			
9.80E+01	7.77E+01	50000000000000000000000.0	1.38E+31			
9.85E+01	7.81E+01	10000000000000000000000.0	2.76E+31			
9.90E+01	7.85E+01	20000000000000000000000.0	5.52E+31			
9.95E+01	7.89E+01	50000000000000000000000.0	1.38E+32			
1.00E+02	7.93E+01	10000000000000000000000.0	2.76E+32			
1.05E+02	7.97E+01	20000000000000000000000.0	5.52E+32			
1.10E+02	8.01E+01	50000000000000000000000.0	1.38E+33			
1.15E+02	8.05E+01	10000000000000000000000.0	2.76E+33			
1.20E+02	8.09E+01	20000000000000000000000.0	5.52E+33			
1.25E+02	8.13E+01	50000000000000000000000.0	1.38E+34			
1.30E+02	8.17E+01	10000000000000000000000.0	2.76E+34			
1.35E+02	8.21E+01	20000000000000000000000.0	5.52E+34			
1.40E+02	8.25E+01	50000000000000000000000.0	1.38E+35			
1.45E+02	8.29E+01	10000000000000000000000.0	2.76E+35			
1.50E+02	8.33E+01	20000000000000000000000.0	5.52E+35			
1.55E+02	8.37E+01	50000000000000000000000.0	1.38E+36			
1.60E+02	8.41E+01	10000000000000000000000.0	2.76E+36			
1.65E+02	8.45E+01	20000000000000000000000.0	5.52E+36			
1.70E+02	8.49E+01	50000000000000000000000.0	1.38E+37			
1.75E+02	8.53E+01	10000000000000000000000.0	2.76E+37			
1.80E+02	8.57E+01	20000000000000000000000.0	5.52E+37			
1.85E+02	8.61E+01	50000000000000000000000.0	1.38E+38			
1.90E+02	8.65E+01	10000000000000000000000.0	2.76E+38			
1.95E+02	8.69E+01	20000000000000000000000.0	5.52E+38			
2.00E+02	8.73E+01	50000000000000000000000.0	1.38E+39			
2.05E+02	8.77E+01	10000000000000000000000.0	2.76E+39			
2.10E+02	8.81E+01	20000000000000000000000.0	5.52E+39			
2.15E+02	8.85E+01	50000000000000000000000.0	1.38E+40			
2.20E+02	8.89E+01	10000000000000000000000.0	2.76E+40			
2.25E+02	8.93E+01	20000000000000000000000.0	5.52E+40			
2.30E+02	8.97E+01	50000000000000000000000.0	1.38E+41			
2.35E+02	9.01E+01	10000000000000000000000.0	2.76E+41			
2.40E+02	9.05E+01	20000000000000000000000.0	5.52E+41			

Table 8b

Atomic Collisions and Pair Productions

Detailed description: This figure is a scatter plot comparing the ratio of differential cross sections for different particle-particle collisions. The vertical axis, labeled 'RATIO', has major tick marks at 0.0, 1.0, and 2.0. The horizontal axis, labeled 'P' (GeV/c), has major tick marks at 0, 2, 4, 6, 8, and 10. Six data series are plotted: 'NUCLEAR' (topmost, mostly '+' symbols), 'PARTIAL' (second from top, mostly '+' symbols), 'DEUTERIUM-PROTON' (third from top, mostly '+' symbols), 'PROTON-PROTON' (fourth from top, mostly '+' symbols), 'COLLISION PAIR' (fifth from top, mostly '+' symbols), and 'ALL' (bottommost, mostly '+' symbols). All series show a similar trend: a sharp initial rise from low to intermediate momentum, followed by a more gradual increase. The 'NUCLEAR' and 'PARTIAL' series reach the highest ratios, around 1.8, while the 'ALL' series reaches the lowest, around 1.2.

Table 8c
URANIUM
Atomic Collisions and Pa-

Table 8d

URANIUM Atomic Collisions and Pair Productions

Table 9a

IRON

Atomic Collisions, Pair Productions, and Bremsstrahlungs

$\frac{1}{L} \cdot \frac{dN}{dx} = 1000 \text{ FF} \cdot 7143996 \cdot 01 \text{ CMSQ/G}$
 $\text{DF}/\text{DX-TOT}$

NUON DE/NX AND RANGF TABLES		NUCLEAR	
NUON	DE/NX	RANGF	DE/NX-PARTIAL
(GeV/C)	(cm/cm ²)	(cm)	(cm/cm ²)
47.0 E-01	55.6 F+01	47.0 E-02	7.3 E-05
68.0 E-01	34.6 F+01	47.0 E-01	7.4 E-04
85.1 E-01	26.9 F+01	0.0000000000000000	2.0 E-04
114.3 E-01	20.8 F+01	0.0000000000000000	1.9 E-04
143.0 E-01	17.1 F+01	0.0000000000000000	1.8 E-04
155.5 E-01	14.7 F+01	0.0000000000000000	1.7 E-04
178.6 E-01	12.6 F+01	0.0000000000000000	1.6 E-04
211.9 E-01	10.7 F+01	0.0000000000000000	1.5 E-04
245.6 E-01	9.0 F+01	0.0000000000000000	1.4 E-04
278.7 E-01	7.5 F+01	0.0000000000000000	1.3 E-04
322.7 E-01	6.2 F+01	0.0000000000000000	1.2 E-04
373.9 E-01	5.1 F+01	0.0000000000000000	1.1 E-04
433.3 E-01	4.1 F+01	0.0000000000000000	1.0 E-04
501.8 E-01	3.2 F+01	0.0000000000000000	9.0 E-05
579.4 E-01	2.4 F+01	0.0000000000000000	8.0 E-05
666.1 E-01	1.7 F+01	0.0000000000000000	7.0 E-05
761.8 E-01	1.2 F+01	0.0000000000000000	6.0 E-05
866.5 E-01	0.9 F+01	0.0000000000000000	5.0 E-05
980.2 E-01	0.6 F+01	0.0000000000000000	4.0 E-05
1101.8 E-01	0.4 F+01	0.0000000000000000	3.0 E-05
1231.4 E-01	0.3 F+01	0.0000000000000000	2.0 E-05
1369.0 E-01	0.2 F+01	0.0000000000000000	1.5 E-05
1514.6 E-01	0.1 F+01	0.0000000000000000	1.0 E-05
1667.2 E-01	0.0 F+01	0.0000000000000000	7.0 E-06
1828.7 E-01	-0.1 F+01	0.0000000000000000	5.0 E-06
2000.0 E-01	-0.2 F+01	0.0000000000000000	3.0 E-06
2180.2 E-01	-0.3 F+01	0.0000000000000000	2.0 E-06
2369.3 E-01	-0.4 F+01	0.0000000000000000	1.5 E-06
2557.3 E-01	-0.5 F+01	0.0000000000000000	1.0 E-06
2744.2 E-01	-0.6 F+01	0.0000000000000000	7.0 E-07
2930.0 E-01	-0.7 F+01	0.0000000000000000	5.0 E-07
3114.7 E-01	-0.8 F+01	0.0000000000000000	3.5 E-07
3308.3 E-01	-0.9 F+01	0.0000000000000000	2.5 E-07
3501.8 E-01	-1.0 F+01	0.0000000000000000	1.8 E-07
3794.2 E-01	-1.1 F+01	0.0000000000000000	1.3 E-07
4086.5 E-01	-1.2 F+01	0.0000000000000000	1.0 E-07
4378.7 E-01	-1.3 F+01	0.0000000000000000	7.5 E-08
4670.8 E-01	-1.4 F+01	0.0000000000000000	5.5 E-08
5052.7 E-01	-1.5 F+01	0.0000000000000000	4.0 E-08
5434.5 E-01	-1.6 F+01	0.0000000000000000	3.0 E-08
5816.2 E-01	-1.7 F+01	0.0000000000000000	2.2 E-08
6197.8 E-01	-1.8 F+01	0.0000000000000000	1.6 E-08
6579.3 E-01	-1.9 F+01	0.0000000000000000	1.2 E-08
6960.7 E-01	-2.0 F+01	0.0000000000000000	9.0 E-09
7342.0 E-01	-2.1 F+01	0.0000000000000000	6.5 E-09
7723.2 E-01	-2.2 F+01	0.0000000000000000	5.0 E-09
8104.3 E-01	-2.3 F+01	0.0000000000000000	4.0 E-09
8485.3 E-01	-2.4 F+01	0.0000000000000000	3.0 E-09
8866.2 E-01	-2.5 F+01	0.0000000000000000	2.5 E-09
9247.0 E-01	-2.6 F+01	0.0000000000000000	2.0 E-09
9627.7 E-01	-2.7 F+01	0.0000000000000000	1.6 E-09
10007.3 E-01	-2.8 F+01	0.0000000000000000	1.3 E-09
10386.8 E-01	-2.9 F+01	0.0000000000000000	1.0 E-09
10766.2 E-01	-3.0 F+01	0.0000000000000000	8.0 E-10
11145.5 E-01	-3.1 F+01	0.0000000000000000	6.5 E-10
11524.7 E-01	-3.2 F+01	0.0000000000000000	5.5 E-10
11903.8 E-01	-3.3 F+01	0.0000000000000000	4.5 E-10
12282.8 E-01	-3.4 F+01	0.0000000000000000	3.8 E-10
12661.7 E-01	-3.5 F+01	0.0000000000000000	3.2 E-10
13040.5 E-01	-3.6 F+01	0.0000000000000000	2.7 E-10
13419.2 E-01	-3.7 F+01	0.0000000000000000	2.2 E-10
13797.8 E-01	-3.8 F+01	0.0000000000000000	1.8 E-10
14176.4 E-01	-3.9 F+01	0.0000000000000000	1.4 E-10
14554.9 E-01	-4.0 F+01	0.0000000000000000	1.1 E-10
14933.3 E-01	-4.1 F+01	0.0000000000000000	8.5 E-11
15311.7 E-01	-4.2 F+01	0.0000000000000000	6.5 E-11
15689.9 E-01	-4.3 F+01	0.0000000000000000	5.0 E-11
16068.0 E-01	-4.4 F+01	0.0000000000000000	4.0 E-11
16446.0 E-01	-4.5 F+01	0.0000000000000000	3.2 E-11
16823.9 E-01	-4.6 F+01	0.0000000000000000	2.5 E-11
17191.7 E-01	-4.7 F+01	0.0000000000000000	2.0 E-11
17569.4 E-01	-4.8 F+01	0.0000000000000000	1.5 E-11
17947.0 E-01	-4.9 F+01	0.0000000000000000	1.2 E-11
18324.5 E-01	-5.0 F+01	0.0000000000000000	1.0 E-11
18692.0 E-01	-5.1 F+01	0.0000000000000000	8.0 E-12
19069.3 E-01	-5.2 F+01	0.0000000000000000	6.5 E-12
19446.5 E-01	-5.3 F+01	0.0000000000000000	5.5 E-12
19823.6 E-01	-5.4 F+01	0.0000000000000000	4.5 E-12
20199.6 E-01	-5.5 F+01	0.0000000000000000	3.8 E-12
20575.5 E-01	-5.6 F+01	0.0000000000000000	3.2 E-12
20951.3 E-01	-5.7 F+01	0.0000000000000000	2.6 E-12
21326.9 E-01	-5.8 F+01	0.0000000000000000	2.1 E-12
21693.4 E-01	-5.9 F+01	0.0000000000000000	1.6 E-12
22060.8 E-01	-6.0 F+01	0.0000000000000000	1.2 E-12
22428.1 E-01	-6.1 F+01	0.0000000000000000	9.5 E-13
22794.3 E-01	-6.2 F+01	0.0000000000000000	7.5 E-13
23160.4 E-01	-6.3 F+01	0.0000000000000000	6.0 E-13
23526.4 E-01	-6.4 F+01	0.0000000000000000	5.0 E-13
23892.3 E-01	-6.5 F+01	0.0000000000000000	4.0 E-13
24258.1 E-01	-6.6 F+01	0.0000000000000000	3.2 E-13
24623.8 E-01	-6.7 F+01	0.0000000000000000	2.5 E-13
25000.0 E-01	-6.8 F+01	0.0000000000000000	2.0 E-13
25376.1 E-01	-6.9 F+01	0.0000000000000000	1.5 E-13
25751.9 E-01	-7.0 F+01	0.0000000000000000	1.2 E-13
26127.6 E-01	-7.1 F+01	0.0000000000000000	9.5 E-14
26493.2 E-01	-7.2 F+01	0.0000000000000000	7.5 E-14
26858.7 E-01	-7.3 F+01	0.0000000000000000	6.0 E-14
27224.1 E-01	-7.4 F+01	0.0000000000000000	4.8 E-14
27589.4 E-01	-7.5 F+01	0.0000000000000000	3.8 E-14
27954.6 E-01	-7.6 F+01	0.0000000000000000	3.0 E-14
28319.7 E-01	-7.7 F+01	0.0000000000000000	2.3 E-14
28684.7 E-01	-7.8 F+01	0.0000000000000000	1.8 E-14
29059.6 E-01	-7.9 F+01	0.0000000000000000	1.4 E-14
29434.4 E-01	-8.0 F+01	0.0000000000000000	1.1 E-14
29809.1 E-01	-8.1 F+01	0.0000000000000000	8.5 E-15
30183.7 E-01	-8.2 F+01	0.0000000000000000	6.5 E-15
30558.2 E-01	-8.3 F+01	0.0000000000000000	5.0 E-15
30932.6 E-01	-8.4 F+01	0.0000000000000000	4.0 E-15
31306.9 E-01	-8.5 F+01	0.0000000000000000	3.2 E-15
31681.1 E-01	-8.6 F+01	0.0000000000000000	2.5 E-15
32055.2 E-01	-8.7 F+01	0.0000000000000000	2.0 E-15
32428.3 E-01	-8.8 F+01	0.0000000000000000	1.5 E-15
32791.3 E-01	-8.9 F+01	0.0000000000000000	1.2 E-15
33164.2 E-01	-9.0 F+01	0.0000000000000000	9.5 E-16
33536.9 E-01	-9.1 F+01	0.0000000000000000	7.5 E-16
33909.5 E-01	-9.2 F+01	0.0000000000000000	6.0 E-16
34281.1 E-01	-9.3 F+01	0.0000000000000000	4.8 E-16
34652.6 E-01	-9.4 F+01	0.0000000000000000	4.0 E-16
35024.0 E-01	-9.5 F+01	0.0000000000000000	3.2 E-16
35395.3 E-01	-9.6 F+01	0.0000000000000000	2.5 E-16
35766.5 E-01	-9.7 F+01	0.0000000000000000	2.0 E-16
36137.6 E-01	-9.8 F+01	0.0000000000000000	1.5 E-16
36508.6 E-01	-9.9 F+01	0.0000000000000000	1.2 E-16
36879.5 E-01	-1.0 F+01	0.0000000000000000	9.5 E-17
37250.4 E-01	-1.1 F+01	0.0000000000000000	7.5 E-17
37621.2 E-01	-1.2 F+01	0.0000000000000000	6.0 E-17
38001.9 E-01	-1.3 F+01	0.0000000000000000	4.8 E-17
38372.5 E-01	-1.4 F+01	0.0000000000000000	4.0 E-17
38753.0 E-01	-1.5 F+01	0.0000000000000000	3.2 E-17
39133.4 E-01	-1.6 F+01	0.0000000000000000	2.5 E-17
39513.7 E-01	-1.7 F+01	0.0000000000000000	2.0 E-17
39894.0 E-01	-1.8 F+01	0.0000000000000000	1.5 E-17
40274.2 E-01	-1.9 F+01	0.0000000000000000	1.2 E-17
40654.3 E-01	-2.0 F+01	0.0000000000000000	9.5 E-18
41034.4 E-01	-2.1 F+01	0.0000000000000000	7.5 E-18
41414.4 E-01	-2.2 F+01	0.0000000000000000	6.0 E-18
41794.3 E-01	-2.3 F+01	0.0000000000000000	4.8 E-18
42174.2 E-01	-2.4 F+01	0.0000000000000000	4.0 E-18
42553.9 E-01	-2.5 F+01	0.0000000000000000	3.2 E-18
42933.6 E-01	-2.6 F+01	0.0000000000000000	2.5 E-18
43313.2 E-01	-2.7 F+01	0.0000000000000000	2.0 E-18
43692.7 E-01	-2.8 F+01	0.0000000000000000	1.5 E-18
44072.1 E-01	-2.9 F+01	0.0000000000000000	1.2 E-18
44451.4 E-01	-3.0 F+01	0.0000000000000000	9.5 E-19
44830.6 E-01	-3.1 F+01	0.0000000000000000	7.5 E-19
45209.8 E-01	-3.2 F+01	0.0000000000000000	6.0 E-19
45588.8 E-01	-3.3 F+01	0.0000000000000000	4.8 E-19
45967.7 E-01	-3.4 F+01	0.0000000000000000	4.0 E-19
46346.5 E-01	-3.5 F+01	0.0000000000000000	3.2 E-19
46725.2 E-01	-3.6 F+01	0.0000000000000000	2.5 E-19
47093.8 E-01	-3.7 F+01	0.0000000000000000	2.0 E-19
47472.3 E-01	-3.8 F+01	0.0000000000000000	1.5 E-19
47849.7 E-01	-3.9 F+01	0.0000000000000000	1.2 E-19
48227.0 E-01	-4.0 F+01	0.0000000000000000	9.5 E-20
48594.2 E-01	-4.1 F+01	0.0000000000000000	7.5 E-20
48961.3 E-01	-4.2 F+01	0.0000000000000000	6.0 E-20
49328.3 E-01	-4.3 F+01	0.0000000000000000	4.8 E-20
49695.2 E-01	-4.4 F+01	0.0000000000000000	4.0 E-20
50062.0 E-01	-4.5 F+01	0.0000000000	

Table 9b

ATOMIC COLLISIONS, PAIR PRODUCTION, AND BREMSSTRAHLUNG

Table 9c

IRON

Atomic Collisions, Pair Productions, and Bremsstrahlungs

Table 9d

IRON

Atomic Collisions, Pair Productions and Bremsstrahlungs

E (GeV)	P (GeV/GM/GMSQ)	DF/DX-TOT (GM/GM/GMSQ)	RANGE (CM)	(FT)	COLLISION (ALL IN GM/GM/GMSQ)	PAIR PROD (ALL IN MEV/GM/GMSQ)	DF/DX-PARTIAL BREMSTRAL	NUCLEAR
.580E+03	.580E+03	.592E+01	.162E+06	.206E+05	.676E+03	.228E+01	.179E+01	.423E+00
.600E+03	.600E+03	.606E+01	.165E+06	.210E+05	.690E+03	.228E+01	.185E+01	.428E+00
.620E+03	.620E+03	.620E+01	.169E+06	.214E+05	.704E+03	.228E+01	.192E+01	.453E+00
.640E+03	.640E+03	.634E+01	.172E+06	.219E+05	.717E+03	.229E+01	.198E+01	.457E+00
.660E+03	.660E+03	.648E+01	.175E+06	.222E+05	.730E+03	.229E+01	.205E+01	.482E+00
.680E+03	.680E+03	.662E+01	.178E+06	.226E+05	.743E+03	.229E+01	.211E+01	.496E+00
.700E+03	.700E+03	.676E+01	.181E+06	.230E+05	.755E+03	.229E+01	.218E+01	.511E+00
.720E+03	.720E+03	.690E+01	.184E+06	.234E+05	.767E+03	.230E+01	.224E+01	.526E+00
.740E+03	.740E+03	.704E+01	.187E+06	.234E+05	.779E+03	.230E+01	.234E+01	.540E+00
.760E+03	.760E+03	.718E+01	.190E+06	.241E+05	.791E+03	.230E+01	.237E+01	.555E+00
.780E+03	.780E+03	.732E+01	.192E+06	.245E+05	.803E+03	.230E+01	.244E+01	.569E+00
.800E+03	.800E+03	.746E+01	.195E+06	.248E+05	.816E+03	.230E+01	.250E+01	.584E+00
.820E+03	.820E+03	.760E+01	.198E+06	.251E+05	.825E+03	.231E+01	.257E+01	.599E+00
.840E+03	.840E+03	.774E+01	.200E+06	.255E+05	.836E+03	.231E+01	.263E+01	.613E+00
.860E+03	.860E+03	.789E+01	.203E+06	.258E+05	.847E+03	.231E+01	.270E+01	.628E+00
.880E+03	.880E+03	.803E+01	.205E+06	.261E+05	.857E+03	.231E+01	.276E+01	.642E+00
.900E+03	.900E+03	.817E+01	.208E+06	.264E+05	.867E+03	.231E+01	.283E+01	.657E+00
.920E+03	.920E+03	.831E+01	.210E+06	.267E+05	.878E+03	.231E+01	.290E+01	.672E+00
.940E+03	.940E+03	.846E+01	.213E+06	.271E+05	.887E+03	.231E+01	.296E+01	.686E+00
.960E+03	.960E+03	.860E+01	.215E+06	.273E+05	.897E+03	.232E+01	.303E+01	.701E+00
.980E+03	.980E+03	.874E+01	.217E+06	.276E+05	.907E+03	.232E+01	.309E+01	.715E+00
.1000E+04	.1000E+04	.989E+01	.220E+06	.279E+05	.916E+03	.232E+01	.316E+01	.730E+00
.1020E+04	.1020E+04	.993E+01	.222E+06	.282E+05	.926E+03	.232E+01	.323E+01	.745E+00
.1040E+04	.1040E+04	.918E+01	.224E+06	.285E+05	.976E+03	.232E+01	.330E+01	.760E+00
.1060E+04	.1060E+04	.933E+01	.227E+06	.288E+05	.946E+03	.232E+01	.337E+01	.776E+00
.1080E+04	.1080E+04	.949E+01	.229E+06	.291E+05	.956E+03	.233E+01	.344E+01	.792E+00
.1100E+04	.1100E+04	.964E+01	.231E+06	.294E+05	.966E+03	.233E+01	.351E+01	.808E+00

Table 10a

SOIL

Atomic Collisions, Pair Productions, and Bremsstrahlungs

MUON DF/DX AND RANGE TABLES

(GFV)	(GFV/C)	(MFV/GM/CM50)	(GM/CM50)	(C4)	(FT)	COLLISION	DE/DX-PARTIAL ALL IN MEV/GM/CM50)	PATR PROD	NUCLEAR
100F-01	470F-01	639F+01	867E+00	434E+00	142E-01	639E+01	0.	0.	730F-01
200F-01	680F-01	791F+01	296E+01	149E+01	485F-01	391E+01	0.	0.	146F-01
300F-01	851F-01	304F+01	549E+01	295F+01	967F-01	304E+01	0.	0.	219F-01
400F-01	100F+00	260F+01	947E+01	474F+01	155F+00	260E+01	0.	0.	292F-01
500F-01	114F+00	233F+01	135F+02	677E+01	222F+00	233E+01	0.	0.	355F-01
600F-01	128F+00	221F+01	180E+02	901E+01	205F+00	216E+01	0.	0.	438F-01
700F-01	140F+00	204F+01	228F+02	114E+02	374E+00	204E+01	0.	0.	511F-01
800F-01	153F+00	195F+01	278E+02	139E+02	456E+00	195E+01	0.	0.	594F-01
900F-01	165F+00	183F+01	330F+02	165E+02	542E+00	188E+01	0.	0.	657F-01
1000F-01	176F+00	183F+01	384E+02	192E+02	624E+00	183E+01	0.	0.	730F-01
1100F-01	188F+00	179F+01	439E+02	220E+02	721F+00	179F+01	0.	0.	809F-01
1200F-01	199F+00	176F+01	496E+02	248F+02	813F+00	176E+01	0.	0.	146F-01
1300F-01	221F+00	174F+01	553E+02	276E+02	907E+00	174F+01	0.	0.	205F-01
1400F-01	222F+00	172F+01	611F+02	305E+02	100E+01	172E+01	0.	0.	270F-01
1500F-01	224F+00	170F+01	669F+02	335F+02	110E+01	170F+01	0.	0.	339F-01
1600F-01	255F+00	167F+01	798F+02	364E+02	120E+01	163E+01	0.	0.	459F-01
1700F-01	266F+00	166F+01	848F+02	424F+02	129F+01	167E+01	0.	0.	559F-01
1800F-01	287F+00	165F+01	908F+02	454F+02	139F+01	166E+01	0.	0.	639F-01
1900F-01	288F+00	164F+01	969F+02	494F+02	159E+01	165F+01	0.	0.	717F-01
2000F-01	329F+00	164F+01	109E+03	545E+02	179F+01	164F+01	0.	0.	797F-01
2100F-01	371F+00	163F+01	121F+03	600E+02	199E+01	164F+01	0.	0.	877F-01
2200F-01	392F+00	163F+01	133F+03	667E+02	219E+01	163E+01	0.	0.	957F-01
2300F-01	412F+00	163F+01	146F+03	729E+02	239E+01	161F+01	0.	0.	103F-01
2400F-01	417F+00	163F+01	158F+03	793E+02	259E+01	163F+01	0.	0.	214F-01
2500F-01	453F+00	163F+01	173F+03	851E+02	279E+01	163F+01	0.	0.	294F-01
2600F-01	453F+00	163F+01	182F+03	912E+02	299E+01	164F+01	0.	0.	375F-01
2700F-01	474F+00	164F+01	195F+03	974E+02	319E+01	164F+01	0.	0.	434F-01
2800F-01	494F+00	164F+01	207F+03	103E+03	339E+01	164F+01	0.	0.	515F-01
2900F-01	515F+00	164F+01	219E+03	110E+03	359E+01	164E+01	0.	0.	582F-01
3000F-01	535F+00	165F+01	231F+03	116E+03	379E+01	165E+01	0.	0.	653F-01
3100F-01	555F+00	165F+01	243F+03	122E+03	399E+01	165F+01	0.	0.	734F-01
3200F-01	576F+00	165F+01	256F+03	134E+03	410E+01	165F+01	0.	0.	823F-01
3300F-01	596F+00	166F+01	268F+03	140E+03	439E+01	165F+01	0.	0.	904F-01
3400F-01	617F+00	167F+01	280F+03	147F+03	459E+01	166F+01	0.	0.	984F-01
3500F-01	637F+00	167F+01	310E+03	155E+03	508E+01	167F+01	0.	0.	1043F-01
3600F-01	659F+00	168F+01	340E+03	170F+03	557E+01	168F+01	0.	0.	1132F-01
3700F-01	749F+00	169F+01	369E+03	185E+03	606E+01	169E+01	0.	0.	1232F-01
3800F-01	799F+00	170F+01	390E+03	199E+03	654E+01	170F+01	0.	0.	1332F-01
3900F-01	449F+00	171F+01	428E+03	214F+03	702E+01	171F+01	0.	0.	1432F-01
4000F-01	390F+00	172F+01	457F+03	229F+03	750E+01	172E+01	0.	0.	1532F-01
4100F-01	450F+00	173F+01	486E+03	247F+03	798E+01	173E+01	0.	0.	1632F-01
4200F-01	515F+00	174F+01	515E+03	253E+03	845E+01	174E+01	0.	0.	1732F-01
4300F-01	546E+00	174F+01	544E+03	272F+03	893E+01	174E+01	0.	0.	1832F-01
4400F-01	573E+00	175F+01	573E+03	286E+03	940E+01	175E+01	0.	0.	1932F-01
4500F-01	630E+00	176F+01	603E+03	315F+03	103E+02	176E+01	0.	0.	2032F-01
4600F-01	646E+00	177F+01	646E+03	343E+03	113E+02	177F+01	0.	0.	2132F-01
4700F-01	743E+00	178F+01	743E+03	371E+03	122F+02	178F+01	0.	0.	2232F-01
4800F-01	794E+00	179F+01	854E+03	399E+03	131E+02	179F+01	0.	0.	2332F-01
4900F-01	909E+00	180F+01	909E+03	427F+03	140F+02	180F+01	0.	0.	2432F-01
5000F-01	964E+00	181F+01	964E+03	454E+03	149E+02	181F+01	0.	0.	2532F-01
5100F-01	102E+01	182F+01	102E+04	482E+03	158E+02	182F+01	0.	0.	2632F-01
5200F-01	113E+01	183F+01	113E+04	509E+03	167E+02	183E+01	0.	0.	2732F-01
5300F-01	123E+01	184F+01	123E+04	536E+03	176E+02	184E+01	0.	0.	2832F-01
5400F-01	134E+01	185F+01	134E+04	563E+03	185E+02	185E+01	0.	0.	2932F-01
5500F-01	145E+01	186F+01	145E+04	617E+03	202E+02	187E+01	0.	0.	3032F-01

Table 10b

SOIL

Atomic Collisions, Pair Productions and Bremsstrahlungs

F	P	DF/DX-TOT	RANGE	(CM)	(FT)	COLLISION	PAIR PROD (ALL IN MEV/GH/GMSQ)	DE/DX-PARTIAL RADIATION	NUCLEAR
(GFV)		(GFV/GH/GMSQ)		(GM/GMSQ)					
.240E+01	.250F+01	.138E+01	.134E+04	.670F+03	.220F+02	.188E+01	.309F-03	.111F-02	.175F-01
.260F+01	.270F+01	.189E+04	.145E+04	.723F+03	.237F+02	.189E+01	.413F-03	.123F-02	.190F-01
.280F+01	.290F+01	.191E+01	.155E+04	.776F+03	.256F+02	.190E+01	.523E-03	.136F-02	.219F-01
.300F+01	.310F+01	.103E+01	.165E+04	.829F+03	.272F+02	.191E+01	.638F-03	.149F-02	.229F-01
.320F+01	.330F+01	.193E+01	.176F+04	.880E+03	.289F+02	.192E+01	.753E-03	.163F-02	.240F-01
.340F+01	.350F+01	.193E+01	.186F+04	.932F+03	.306F+02	.193E+01	.882E-03	.176F-02	.250F-01
.360F+01	.370F+01	.196E+01	.197E+04	.984F+03	.323E+02	.194E+01	.101F-02	.190F-02	.260F-01
.380F+01	.390F+01	.199E+01	.207F+04	.104F+04	.340F+02	.195E+01	.114F-02	.204F-02	.270F-01
.400F+01	.410F+01	.196F+01	.217F+04	.109E+04	.356F+02	.196E+01	.128E-02	.218F-02	.280F-01
.420F+01	.430F+01	.197E+01	.227F+04	.114F+04	.373E+02	.197E+01	.142F-02	.232F-02	.290F-01
.440F+01	.450F+01	.197E+01	.238F+04	.119F+04	.390F+02	.197E+01	.157E-02	.246F-02	.300F-01
.460F+01	.470F+01	.198E+01	.248F+04	.124F+04	.406E+02	.197F+01	.172F-02	.261F-02	.310F-01
.480F+01	.490F+01	.199F+01	.258F+04	.129F+04	.423E+02	.198F+01	.187E-02	.276F-02	.320F-01
.500F+01	.510F+01	.199F+01	.268F+04	.134F+04	.440E+02	.199F+01	.202E-02	.290F-02	.330F-01
.520F+01	.530F+01	.200F+01	.293F+04	.146F+04	.481E+02	.200F+01	.242F-02	.324F-02	.340F-01
.540F+01	.550F+01	.610F+01	.302F+04	.159F+04	.531E+02	.201F+01	.284E-02	.366F-02	.350F-01
.560F+01	.570F+01	.203F+01	.318F+04	.171E+04	.562E+02	.202F+01	.327F-02	.405F-02	.360F-01
.580F+01	.590F+01	.710F+01	.204F+04	.367F+04	.602F+02	.203E+01	.371F-02	.445F-02	.370F-01
.600F+01	.610F+01	.760F+01	.205F+04	.392F+04	.184E+04	.602F+02	.204E+01	.417F-02	.484F-02
.620F+01	.630F+01	.810F+01	.206F+04	.416F+04	.642F+02	.205E+01	.464E-02	.525F-02	.504F-01
.640F+01	.650F+01	.860F+01	.207F+04	.440F+04	.722F+02	.206E+01	.513E-02	.565F-02	.523F-01
.660F+01	.670F+01	.910F+01	.207F+04	.454F+04	.762F+02	.207E+01	.552E-02	.605F-02	.542F-01
.680F+01	.690F+01	.961F+01	.209F+04	.488F+04	.801F+02	.207E+01	.613E-02	.664F-02	.561F-01
.700F+02	.710F+02	.101F+02	.209F+04	.512F+04	.841F+02	.207E+01	.664F-02	.723F-02	.580F-01
.720F+02	.730F+02	.111F+02	.211F+04	.560E+04	.919F+02	.208E+01	.770E-02	.779F-02	.600F-01
.740F+02	.750F+02	.121F+02	.211F+04	.604E+04	.997F+02	.210E+01	.879F-02	.824F-02	.620F-01
.760F+02	.770F+02	.131F+02	.212F+04	.655F+04	.107E+03	.210E+01	.991F-02	.865F-02	.640F-01
.780F+02	.790F+02	.141F+02	.213F+04	.702F+04	.115E+03	.211E+01	.111F-01	.905F-01	.660F-01
.800F+02	.810F+02	.151F+02	.214F+04	.749F+04	.123E+03	.212E+01	.122F-01	.104E-01	.680F-01
.820F+02	.830F+02	.161F+02	.215F+04	.793F+04	.130E+03	.213E+01	.134E-01	.123F-01	.700F-01
.840F+02	.850F+02	.171F+02	.216F+04	.841F+04	.142E+03	.213E+01	.147F-01	.143F-01	.720F-01
.860F+02	.870F+02	.181F+02	.217F+04	.888F+04	.146E+03	.214E+01	.159F-01	.154F-01	.740F-01
.880F+02	.890F+02	.191F+02	.218F+04	.934F+04	.153E+03	.214E+01	.172F-01	.161F-01	.760F-01
.900F+02	.910F+02	.201F+02	.218F+04	.980F+04	.161E+03	.215E+01	.185F-01	.181F-01	.780F-01
.920F+02	.930F+02	.221F+02	.220F+04	.107E+05	.176E+03	.216E+01	.211E-01	.200F-01	.800F-01
.940F+02	.950F+02	.241F+02	.221F+04	.115E+05	.581E+04	.191E+03	.217E+01	.238F-01	.820F-01
.960F+02	.970F+02	.261F+02	.224F+04	.126E+05	.626E+04	.191E+03	.218E+01	.294F-01	.840F-01
.980F+02	.990F+02	.301F+02	.224F+04	.134E+05	.571E+04	.205E+03	.218E+01	.313E-01	.860F-01
.1000F+02	.1010F+02	.321F+02	.225F+04	.143E+05	.715F+04	.235E+03	.219E+01	.364F-01	.219F-01
.1020F+02	.1030F+02	.341F+02	.226F+04	.152E+05	.760F+04	.249E+03	.220E+01	.382E-01	.234F-01
.1040F+02	.1050F+02	.361F+02	.227F+04	.160E+05	.804F+04	.264E+03	.220E+01	.382E-01	.303F-01
.1060F+02	.1070F+02	.381F+02	.228F+04	.168E+05	.848F+04	.278E+03	.221E+01	.406E-01	.377F-01
.1080F+02	.1090F+02	.401F+02	.230F+04	.178E+05	.892F+04	.293E+03	.222E+01	.431F-01	.407F-01
.1100F+02	.1110F+02	.421F+02	.230F+04	.187E+05	.935E+04	.307E+03	.222E+01	.455F-01	.427F-01
.1120F+02	.1130F+02	.441F+02	.231F+04	.195E+05	.979F+04	.321E+03	.222E+01	.480F-01	.457F-01
.1140F+02	.1150F+02	.461F+02	.232F+04	.204E+05	.102E+05	.335E+03	.222E+01	.504E-01	.482F-01
.1160F+02	.1170F+02	.481F+02	.233F+04	.213E+05	.107E+05	.364F+03	.223E+01	.529E-01	.513F-01
.1180F+02	.1190F+02	.501F+02	.234F+04	.222E+05	.111E+05	.389E+03	.223E+01	.554E-01	.544F-01
.1200F+02	.1210F+02	.521F+02	.235F+04	.230E+05	.126F+05	.417F+03	.224E+01	.616F-01	.533F-01
.1220F+02	.1230F+02	.541F+02	.236F+04	.239E+05	.136F+05	.447F+03	.225E+01	.679F-01	.590F-01
.1240F+02	.1250F+02	.561F+02	.237F+04	.248E+05	.147F+05	.492F+03	.226E+01	.742F-01	.647F-01
.1260F+02	.1270F+02	.581F+02	.238F+04	.257E+05	.157E+05	.516F+03	.226E+01	.805F-01	.706F-01
.1280F+02	.1290F+02	.601F+02	.239F+04	.266E+05	.165F+05	.550F+03	.227E+01	.868F-01	.764F-01
.1300F+02	.1310F+02	.621F+02	.240F+04	.276E+05	.178E+05	.583E+03	.227E+01	.932F-01	.824F-01
.1320F+02	.1330F+02	.641F+02	.276E+05	.188E+05	.187E+05	.617F+03	.228E+01	.996F-01	.884F-01

Table 10c

Atomic Collisions, Pair Productions, and Bremsstrahlungs

Table 10d

SOIL

Atomic Collisions, Pair Productions, and Bremsstrahlungs

E (GeV)	P (GeV/C)	DE/DX-TOT (MeV/GM/CM _{SO})	RANGE (cm)	COLLISION (ft)	PAIR PROD (ALL IN MeV/GM/CM _{SO})	DE/DX-PARTIAL NUCLEAR			
.580E+03	.580E+03	.398E+01	.194E+06	.968E+05	.318E+04	.243E+01	.774E+00	.787E+00	.423E+03
.600E+03	.600E+03	.404E+01	.199E+06	.993E+05	.326E+04	.243E+01	.802E+00	.814E+00	.439E+03
.620E+03	.620E+03	.411E+01	.203E+06	.102E+06	.334E+04	.243E+01	.830E+00	.844E+00	.453E+03
.640E+03	.640E+03	.417E+01	.208E+06	.104E+06	.342E+04	.243E+01	.858E+00	.975E+03	.467E+03
.660E+03	.660E+03	.423E+01	.213E+06	.107E+06	.350E+04	.244E+01	.886E+00	.905E+00	.482E+03
.680E+03	.680E+03	.429E+01	.218E+06	.109E+06	.357E+04	.244E+01	.914E+00	.934E+00	.496E+03
.700E+03	.700E+03	.435E+01	.222E+06	.113E+06	.365E+04	.244E+01	.943E+00	.967E+00	.511E+03
.720E+03	.720E+03	.441E+01	.227E+06	.116E+06	.372E+04	.244E+01	.971E+00	.998E+00	.526E+03
.740E+03	.740E+03	.447E+01	.231E+06	.119E+06	.380E+04	.244E+01	.999E+00	.103E+01	.540E+03
.760E+03	.760E+03	.453E+01	.236E+06	.120E+06	.397E+04	.245E+01	.103E+01	.105E+01	.555E+03
.780E+03	.780E+03	.459E+01	.240E+06	.122E+06	.394E+04	.245E+01	.106E+01	.109E+01	.569E+03
.800E+03	.800E+03	.465E+01	.245E+06	.124E+06	.401E+04	.245E+01	.108E+01	.112E+01	.584E+03
.820E+03	.820E+03	.471E+01	.249E+06	.124E+06	.408E+04	.245E+01	.111E+01	.115E+01	.599E+03
.840E+03	.840E+03	.478E+01	.253E+06	.127E+06	.415E+04	.245E+01	.114E+01	.119E+01	.613E+03
.860E+03	.860E+03	.484E+01	.257E+06	.129E+06	.422E+04	.246E+01	.117E+01	.122E+01	.628E+03
.880E+03	.880E+03	.490E+01	.261E+06	.131E+06	.429E+04	.246E+01	.120E+01	.125E+01	.642E+03
.900E+03	.900E+03	.496E+01	.265E+06	.133E+06	.435E+04	.246E+01	.123E+01	.128E+01	.657E+03
.920E+03	.920E+03	.503E+01	.269E+06	.135E+06	.442E+04	.246E+01	.125E+01	.131E+01	.672E+03
.940E+03	.940E+03	.509E+01	.273E+06	.137E+06	.448E+04	.246E+01	.128E+01	.134E+01	.686E+03
.960E+03	.960E+03	.515E+01	.277E+06	.139E+06	.455E+04	.246E+01	.131E+01	.137E+01	.701E+03
.980E+03	.980E+03	.521E+01	.281E+06	.141E+06	.461E+04	.246E+01	.134E+01	.141E+01	.715E+03
.1000E+04	.1000E+04	.527E+01	.285E+06	.142E+06	.467E+04	.247E+01	.137E+01	.144E+01	.728E+03
.1020E+04	.1020E+04	.534E+01	.289E+06	.144E+06	.474E+04	.247E+01	.140E+01	.147E+01	.745E+03
.1040E+04	.1040E+04	.540E+01	.293E+06	.146E+06	.480E+04	.247E+01	.143E+01	.151E+01	.760E+03
.1060E+04	.1060E+04	.546E+01	.297E+06	.148E+06	.487E+04	.247F+01	.146E+01	.154E+01	.776E+03
.1080E+04	.1080E+04	.553E+01	.301E+06	.150E+06	.494E+04	.247E+01	.149E+01	.158E+01	.792E+03
.1100E+04	.1100E+04	.560E+01	.305E+06	.153E+06	.500E+04	.247E+01	.152E+01	.161E+01	.808E+03

Table 11a

Atomic Collisions, Pair Productions, and Bremsstrahlungs

MUON DE/D_X AND RANGE TABLES

Table 11b

LEAD

Atomic Collisions, Pair Productions, and Bremsstrahlungs

E	P	DF/DX-TOT	RANGE	COLLISION	PAIR PROD	DF/DX-PARTIAL (ALL IN MEV/G4/CMSQ)	BREMSSTRAL	NUCLFAR
1.00E+01	(GFV1)	(GFV/C)	(MFV/GM/GMSQ)	(GM/GMSQ)	(CM)	(FT)		
2.00E+01	2.40E+01	2.50E+01	1.43E+01	1.84E+04	1.61E+03	5.29E+01	1.42E+01	2.07E-02
2.00E+01	2.50E+01	2.70E+01	1.44E+01	1.98E+04	1.73E+03	5.59E+01	1.43E+01	2.71E-02
2.00E+01	2.70E+01	2.90E+01	1.45E+01	2.12E+04	1.86E+03	6.09E+01	1.44E+01	3.42E-02
2.00E+01	3.00E+01	3.10E+01	1.46E+01	2.25E+04	1.98E+03	6.48E+01	1.45E+01	4.18E-02
2.00E+01	3.20E+01	3.30E+01	1.47E+01	2.39E+04	2.10E+03	6.87E+01	1.46E+01	4.96E-02
2.00E+01	3.40E+01	3.50E+01	1.49E+01	2.52E+04	2.21E+03	7.26E+01	1.47E+01	5.78E-02
2.00E+01	3.60E+01	3.70E+01	1.49E+01	2.66E+04	2.33E+03	7.65E+01	1.48E+01	6.63E-02
2.00E+01	3.80E+01	3.90E+01	1.50E+01	2.79E+04	2.45E+03	8.03E+01	1.49E+01	7.50E-02
2.00E+01	4.00E+01	4.10E+01	1.51E+01	2.92E+04	2.57E+03	8.42E+01	1.49E+01	8.37E-02
2.00E+01	4.20E+01	4.30E+01	1.52E+01	3.06E+04	2.68E+03	8.79E+01	1.50E+01	9.21E-02
2.00E+01	4.40E+01	4.50E+01	1.53E+01	3.19E+04	2.80E+03	9.17E+01	1.51E+01	1.03E-01
2.00E+01	4.60E+01	4.70E+01	1.54E+01	3.32E+04	2.91E+03	9.55E+01	1.51E+01	1.12E-01
2.00E+01	4.80E+01	4.90E+01	1.55E+01	3.45E+04	3.02E+03	9.92E+01	1.52E+01	1.22E-01
2.00E+01	5.00E+01	5.10E+01	1.56E+01	3.58E+04	3.14E+03	1.03E+02	1.52E+01	1.32E-01
2.00E+01	5.20E+01	5.30E+01	1.57E+01	3.70E+04	3.26E+03	1.07E+02	1.53E+01	1.42E-01
2.00E+01	5.40E+01	5.50E+01	1.58E+01	3.82E+04	3.37E+03	1.11E+02	1.54E+01	1.52E-01
2.00E+01	5.60E+01	5.70E+01	1.59E+01	3.94E+04	3.48E+03	1.15E+02	1.55E+01	1.62E-01
2.00E+01	5.80E+01	5.90E+01	1.60E+01	4.06E+04	3.59E+03	1.19E+02	1.56E+01	1.72E-01
2.00E+01	6.00E+01	6.10E+01	1.61E+01	4.18E+04	3.70E+03	1.23E+02	1.57E+01	1.82E-01
2.00E+01	6.20E+01	6.30E+01	1.62E+01	4.30E+04	3.81E+03	1.27E+02	1.58E+01	1.92E-01
2.00E+01	6.40E+01	6.50E+01	1.63E+01	4.42E+04	3.92E+03	1.31E+02	1.59E+01	2.02E-01
2.00E+01	6.60E+01	6.70E+01	1.64E+01	4.54E+04	4.03E+03	1.35E+02	1.60E+01	2.12E-01
2.00E+01	6.80E+01	6.90E+01	1.65E+01	4.66E+04	4.14E+03	1.39E+02	1.61E+01	2.22E-01
2.00E+01	7.00E+01	7.10E+01	1.66E+01	4.78E+04	4.25E+03	1.43E+02	1.62E+01	2.32E-01
2.00E+01	7.20E+01	7.30E+01	1.67E+01	4.90E+04	4.36E+03	1.47E+02	1.63E+01	2.42E-01
2.00E+01	7.40E+01	7.50E+01	1.68E+01	5.02E+04	4.47E+03	1.51E+02	1.64E+01	2.52E-01
2.00E+01	7.60E+01	7.70E+01	1.69E+01	5.14E+04	4.58E+03	1.55E+02	1.65E+01	2.62E-01
2.00E+01	7.80E+01	7.90E+01	1.70E+01	5.26E+04	4.69E+03	1.59E+02	1.66E+01	2.72E-01
2.00E+01	8.00E+01	8.10E+01	1.71E+01	5.38E+04	4.80E+03	1.63E+02	1.67E+01	2.82E-01
2.00E+01	8.20E+01	8.30E+01	1.72E+01	5.50E+04	4.91E+03	1.67E+02	1.68E+01	2.92E-01
2.00E+01	8.40E+01	8.50E+01	1.73E+01	5.62E+04	5.02E+03	1.71E+02	1.69E+01	3.02E-01
2.00E+01	8.60E+01	8.70E+01	1.74E+01	5.74E+04	5.13E+03	1.75E+02	1.70E+01	3.12E-01
2.00E+01	8.80E+01	8.90E+01	1.75E+01	5.86E+04	5.24E+03	1.79E+02	1.71E+01	3.22E-01
2.00E+01	9.00E+01	9.10E+01	1.76E+01	5.98E+04	5.35E+03	1.83E+02	1.72E+01	3.32E-01
2.00E+01	9.20E+01	9.30E+01	1.77E+01	6.10E+04	5.46E+03	1.87E+02	1.73E+01	3.42E-01
2.00E+01	9.40E+01	9.50E+01	1.78E+01	6.22E+04	5.57E+03	1.91E+02	1.74E+01	3.52E-01
2.00E+01	9.60E+01	9.70E+01	1.79E+01	6.34E+04	5.68E+03	1.95E+02	1.75E+01	3.62E-01
2.00E+01	9.80E+01	9.90E+01	1.80E+01	6.46E+04	5.79E+03	1.99E+02	1.76E+01	3.72E-01
2.00E+01	1.00E+02	1.01E+02	1.81E+01	6.58E+04	5.90E+03	2.03E+02	1.77E+01	3.82E-01
2.00E+01	1.02E+02	1.03E+02	1.82E+01	6.70E+04	6.01E+03	2.07E+02	1.78E+01	3.92E-01
2.00E+01	1.04E+02	1.05E+02	1.83E+01	6.82E+04	6.12E+03	2.11E+02	1.79E+01	4.02E-01
2.00E+01	1.06E+02	1.07E+02	1.84E+01	6.94E+04	6.23E+03	2.15E+02	1.80E+01	4.12E-01
2.00E+01	1.08E+02	1.09E+02	1.85E+01	7.06E+04	6.34E+03	2.19E+02	1.81E+01	4.22E-01
2.00E+01	1.10E+02	1.11E+02	1.86E+01	7.18E+04	6.45E+03	2.23E+02	1.82E+01	4.32E-01
2.00E+01	1.12E+02	1.13E+02	1.87E+01	7.30E+04	6.56E+03	2.27E+02	1.83E+01	4.42E-01
2.00E+01	1.14E+02	1.15E+02	1.88E+01	7.42E+04	6.67E+03	2.31E+02	1.84E+01	4.52E-01
2.00E+01	1.16E+02	1.17E+02	1.89E+01	7.54E+04	6.78E+03	2.35E+02	1.85E+01	4.62E-01
2.00E+01	1.18E+02	1.19E+02	1.90E+01	7.66E+04	6.89E+03	2.39E+02	1.86E+01	4.72E-01
2.00E+01	1.20E+02	1.21E+02	1.91E+01	7.78E+04	6.99E+03	2.43E+02	1.87E+01	4.82E-01
2.00E+01	1.22E+02	1.23E+02	1.92E+01	7.90E+04	7.10E+03	2.47E+02	1.88E+01	4.92E-01
2.00E+01	1.24E+02	1.25E+02	1.93E+01	8.02E+04	7.21E+03	2.51E+02	1.89E+01	5.02E-01
2.00E+01	1.26E+02	1.27E+02	1.94E+01	8.14E+04	7.32E+03	2.55E+02	1.90E+01	5.12E-01
2.00E+01	1.28E+02	1.29E+02	1.95E+01	8.26E+04	7.43E+03	2.59E+02	1.91E+01	5.22E-01
2.00E+01	1.30E+02	1.31E+02	1.96E+01	8.38E+04	7.54E+03	2.63E+02	1.92E+01	5.32E-01
2.00E+01	1.32E+02	1.33E+02	1.97E+01	8.50E+04	7.65E+03	2.67E+02	1.93E+01	5.42E-01
2.00E+01	1.34E+02	1.35E+02	1.98E+01	8.62E+04	7.76E+03	2.71E+02	1.94E+01	5.52E-01
2.00E+01	1.36E+02	1.37E+02	1.99E+01	8.74E+04	7.87E+03	2.75E+02	1.95E+01	5.62E-01
2.00E+01	1.38E+02	1.39E+02	2.00E+01	8.86E+04	7.98E+03	2.79E+02	1.96E+01	5.72E-01
2.00E+01	1.40E+02	1.41E+02	2.01E+01	8.98E+04	8.09E+03	2.83E+02	1.97E+01	5.82E-01
2.00E+01	1.42E+02	1.43E+02	2.02E+01	9.10E+04	8.20E+03	2.87E+02	1.98E+01	5.92E-01
2.00E+01	1.44E+02	1.45E+02	2.03E+01	9.22E+04	8.31E+03	2.91E+02	1.99E+01	6.02E-01
2.00E+01	1.46E+02	1.47E+02	2.04E+01	9.34E+04	8.42E+03	2.95E+02	2.00E+01	6.12E-01
2.00E+01	1.48E+02	1.49E+02	2.05E+01	9.46E+04	8.53E+03	2.99E+02	2.01E+01	6.22E-01
2.00E+01	1.50E+02	1.51E+02	2.06E+01	9.58E+04	8.64E+03	3.03E+02	2.02E+01	6.32E-01
2.00E+01	1.52E+02	1.53E+02	2.07E+01	9.70E+04	8.75E+03	3.07E+02	2.03E+01	6.42E-01
2.00E+01	1.54E+02	1.55E+02	2.08E+01	9.82E+04	8.86E+03	3.11E+02	2.04E+01	6.52E-01
2.00E+01	1.56E+02	1.57E+02	2.09E+01	9.94E+04	8.97E+03	3.15E+02	2.05E+01	6.62E-01
2.00E+01	1.58E+02	1.59E+02	2.10E+01	1.006E+05	9.08E+03	3.19E+02	2.06E+01	6.72E-01
2.00E+01	1.60E+02	1.61E+02	2.11E+01	1.018E+05	9.20E+03	3.23E+02	2.07E+01	6.82E-01
2.00E+01	1.62E+02	1.63E+02	2.12E+01	1.030E+05	9.32E+03	3.27E+02	2.08E+01	6.92E-01
2.00E+01	1.64E+02	1.65E+02	2.13E+01	1.042E+05	9.44E+03	3.31E+02	2.09E+01	7.02E-01
2.00E+01	1.66E+02	1.67E+02	2.14E+01	1.054E+05	9.56E+03	3.35E+02	2.10E+01	7.12E-01
2.00E+01	1.68E+02	1.69E+02	2.15E+01	1.066E+05	9.68E+03	3.39E+02	2.11E+01	7.22E-01
2.00E+01	1.70E+02	1.71E+02	2.16E+01	1.078E+05	9.80E+03	3.43E+02	2.12E+01	7.32E-01
2.00E+01	1.72E+02	1.73E+02	2.17E+01	1.090E+05	9.92E+03	3.47E+02	2.13E+01	7.42E-01
2.00E+01	1.74E+02	1.75E+02	2.18E+01	1.102E+05	1.004E+04	3.51E+02	2.14E+01	7.52E-01
2.00E+01	1.76E+02	1.77E+02	2.19E+01	1.114E+05	1.016E+04	3.55E+02	2.15E+01	7.62E-01
2.00E+01	1.78E+02	1.79E+02	2.20E+01	1.126E+05	1.028E+04	3.59E+02	2.16E+01	7.72E-01
2.00E+01	1.80E+02	1.81E+02	2.21E+01	1.138E+05	1.040E+04	3.63E+02	2.17E+01	7.82E-01
2.00E+01	1.82E+02	1.83E+02	2.22E+01	1.150E+05	1.052E+04	3.67E+02	2.18E+01	7.92E-01
2.00E+01	1.84E+02	1.85E+02	2.23E+01	1.162E+05	1.064E+04	3.71E+02	2.19E+01	8.02E-01
2.00E+01	1.86E+02	1.87E+02	2.24E+01	1.174E+05	1.076E+04	3.75E+02	2.20E+01	8.12E-01
2.00E+01	1.88E+02	1.89E+02	2.25E+01	1.186E+05	1.088E+04	3.79E+02	2.21E+01	8.22E-01
2.00E+01	1.90E+02	1.91E+02	2.26E+01	1.198E+05	1.100E+04	3.83E+02	2.22E+01	8.32E-01
2.00E+01	1.92E+02	1.93E+02	2.27E+01	1.210E+05	1.112E+04	3.87E+02	2.23E+01	8.42E-01
2.00E+01	1.94E+02	1.95E+02	2.28E+01	1.222E+05	1.124E+04	3.91E+02	2.24E+01	8.52E-01
2.00E+01	1.96E+02	1.97E+02	2.29E+01	1.234E+05	1.136E+04	3.95E+02	2.25E+01	

Table 11c

Atomic Collisions, Pair Productions, and Bremsstrahlungs LEAD

P	NE/DX-TOT	(GFV/CV S0)	(GW/GM S0)	RANGE	(CM)	COLLISION (ALL)	PAIR PROD (0.1-1/GeV)	NE/DX-PARTIAL	NUCLEAR
0.01	2.96E+00	4.15E+05	4.37E+05	0.00E+00	3.64E+04	1.19F+03	6.07E+00	6.57E+00	6.57E+00
0.05	3.04E+00	4.44E+05	4.79E+05	0.00E+00	3.70E+04	1.24F+03	6.47E+00	6.96E+00	6.96E+00
0.1	3.02E+00	4.74E+05	5.10E+05	0.00E+00	3.75E+04	1.28F+03	6.87E+00	7.35E+00	7.35E+00
0.2	3.00E+00	5.04E+05	5.41E+05	0.00E+00	3.80E+04	1.32F+03	7.28E+00	7.73E+00	7.73E+00
0.5	2.98E+00	5.34E+05	5.72E+05	0.00E+00	3.85E+04	1.36F+03	7.69E+00	8.12E+00	8.12E+00
1.0	2.96E+00	5.64E+05	6.03E+05	0.00E+00	3.90E+04	1.40F+03	8.10E+00	8.51E+00	8.51E+00
2.0	2.94E+00	6.04E+05	6.43E+05	0.00E+00	3.95E+04	1.44F+03	8.51E+00	8.90E+00	8.90E+00
4.0	2.92E+00	6.44E+05	6.84E+05	0.00E+00	4.00E+04	1.48F+03	8.92E+00	9.29E+00	9.29E+00
8.0	2.90E+00	6.84E+05	7.24E+05	0.00E+00	4.05E+04	1.52F+03	9.33E+00	9.68E+00	9.68E+00
16.0	2.88E+00	7.24E+05	7.65E+05	0.00E+00	4.10E+04	1.56F+03	9.74E+00	1.007E+01	1.007E+01
32.0	2.86E+00	7.64E+05	8.05E+05	0.00E+00	4.15E+04	1.60F+03	1.018E+01	1.046E+01	1.046E+01
64.0	2.84E+00	8.04E+05	8.46E+05	0.00E+00	4.20E+04	1.64F+03	1.059E+01	1.085E+01	1.085E+01
128.0	2.82E+00	8.44E+05	8.86E+05	0.00E+00	4.25E+04	1.68F+03	1.100E+01	1.121E+01	1.121E+01
256.0	2.80E+00	8.84E+05	9.27E+05	0.00E+00	4.30E+04	1.72F+03	1.141E+01	1.161E+01	1.161E+01
512.0	2.78E+00	9.24E+05	9.67E+05	0.00E+00	4.35E+04	1.76F+03	1.182E+01	1.201E+01	1.201E+01
1024.0	2.76E+00	9.64E+05	1.008E+06	0.00E+00	4.40E+04	1.80F+03	1.223E+01	1.240E+01	1.240E+01
2048.0	2.74E+00	1.004E+06	1.048E+06	0.00E+00	4.45E+04	1.84F+03	1.264E+01	1.279E+01	1.279E+01
4096.0	2.72E+00	1.044E+06	1.088E+06	0.00E+00	4.50E+04	1.88F+03	1.305E+01	1.318E+01	1.318E+01
8192.0	2.70E+00	1.084E+06	1.128E+06	0.00E+00	4.55E+04	1.92F+03	1.346E+01	1.337E+01	1.337E+01
16384.0	2.68E+00	1.124E+06	1.168E+06	0.00E+00	4.60E+04	1.96F+03	1.387E+01	1.328E+01	1.328E+01
32768.0	2.66E+00	1.164E+06	1.208E+06	0.00E+00	4.65E+04	2.00F+03	1.428E+01	1.319E+01	1.319E+01
65536.0	2.64E+00	1.204E+06	1.248E+06	0.00E+00	4.70E+04	2.04F+03	1.469E+01	1.310E+01	1.310E+01
131072.0	2.62E+00	1.244E+06	1.288E+06	0.00E+00	4.75E+04	2.08F+03	1.510E+01	1.301E+01	1.301E+01
262144.0	2.60E+00	1.284E+06	1.328E+06	0.00E+00	4.80E+04	2.12F+03	1.551E+01	1.292E+01	1.292E+01
524288.0	2.58E+00	1.324E+06	1.368E+06	0.00E+00	4.85E+04	2.16F+03	1.592E+01	1.283E+01	1.283E+01
1048576.0	2.56E+00	1.364E+06	1.408E+06	0.00E+00	4.90E+04	2.20F+03	1.633E+01	1.274E+01	1.274E+01
2097152.0	2.54E+00	1.404E+06	1.448E+06	0.00E+00	4.95E+04	2.24F+03	1.674E+01	1.265E+01	1.265E+01
4194304.0	2.52E+00	1.444E+06	1.488E+06	0.00E+00	5.00E+04	2.28F+03	1.715E+01	1.256E+01	1.256E+01
8388608.0	2.50E+00	1.484E+06	1.528E+06	0.00E+00	5.05E+04	2.32F+03	1.756E+01	1.247E+01	1.247E+01
16777216.0	2.48E+00	1.524E+06	1.568E+06	0.00E+00	5.10E+04	2.36F+03	1.797E+01	1.238E+01	1.238E+01
33554432.0	2.46E+00	1.564E+06	1.608E+06	0.00E+00	5.15E+04	2.40F+03	1.838E+01	1.229E+01	1.229E+01
67108864.0	2.44E+00	1.604E+06	1.648E+06	0.00E+00	5.20E+04	2.44F+03	1.879E+01	1.220E+01	1.220E+01
134217728.0	2.42E+00	1.644E+06	1.688E+06	0.00E+00	5.25E+04	2.48F+03	1.920E+01	1.211E+01	1.211E+01
268435456.0	2.40E+00	1.684E+06	1.728E+06	0.00E+00	5.30E+04	2.52F+03	1.961E+01	1.202E+01	1.202E+01
536870912.0	2.38E+00	1.724E+06	1.768E+06	0.00E+00	5.35E+04	2.56F+03	1.992E+01	1.193E+01	1.193E+01
1073741824.0	2.36E+00	1.764E+06	1.808E+06	0.00E+00	5.40E+04	2.60F+03	2.033E+01	1.184E+01	1.184E+01
2147483648.0	2.34E+00	1.804E+06	1.848E+06	0.00E+00	5.45E+04	2.64F+03	2.074E+01	1.175E+01	1.175E+01
4294967296.0	2.32E+00	1.844E+06	1.888E+06	0.00E+00	5.50E+04	2.68F+03	2.115E+01	1.166E+01	1.166E+01
8589934592.0	2.30E+00	1.884E+06	1.928E+06	0.00E+00	5.55E+04	2.72F+03	2.156E+01	1.157E+01	1.157E+01
17179869184.0	2.28E+00	1.924E+06	1.968E+06	0.00E+00	5.60E+04	2.76F+03	2.197E+01	1.148E+01	1.148E+01
34359738368.0	2.26E+00	1.964E+06	2.008E+06	0.00E+00	5.65E+04	2.80F+03	2.238E+01	1.139E+01	1.139E+01
68719476736.0	2.24E+00	2.004E+06	2.048E+06	0.00E+00	5.70E+04	2.84F+03	2.279E+01	1.130E+01	1.130E+01
137438953472.0	2.22E+00	2.044E+06	2.088E+06	0.00E+00	5.75E+04	2.88F+03	2.320E+01	1.121E+01	1.121E+01
274877906944.0	2.20E+00	2.084E+06	2.128E+06	0.00E+00	5.80E+04	2.92F+03	2.361E+01	1.112E+01	1.112E+01
549755813888.0	2.18E+00	2.124E+06	2.168E+06	0.00E+00	5.85E+04	2.96F+03	2.402E+01	1.103E+01	1.103E+01
1099511627776.0	2.16E+00	2.164E+06	2.208E+06	0.00E+00	5.90E+04	3.00F+03	2.443E+01	1.094E+01	1.094E+01
2199023255552.0	2.14E+00	2.204E+06	2.248E+06	0.00E+00	5.95E+04	3.04F+03	2.484E+01	1.085E+01	1.085E+01
4398046511104.0	2.12E+00	2.244E+06	2.288E+06	0.00E+00	6.00E+04	3.08F+03	2.525E+01	1.076E+01	1.076E+01
8796093022208.0	2.10E+00	2.284E+06	2.328E+06	0.00E+00	6.05E+04	3.12F+03	2.566E+01	1.067E+01	1.067E+01
17592186044016.0	2.08E+00	2.324E+06	2.368E+06	0.00E+00	6.10E+04	3.16F+03	2.607E+01	1.058E+01	1.058E+01
35184372088032.0	2.06E+00	2.364E+06	2.408E+06	0.00E+00	6.15E+04	3.20F+03	2.648E+01	1.049E+01	1.049E+01
70368744176064.0	2.04E+00	2.404E+06	2.448E+06	0.00E+00	6.20E+04	3.24F+03	2.689E+01	1.040E+01	1.040E+01
140737488332128.0	2.02E+00	2.444E+06	2.488E+06	0.00E+00	6.25E+04	3.28F+03	2.730E+01	1.031E+01	1.031E+01
281474976664256.0	2.00E+00	2.484E+06	2.528E+06	0.00E+00	6.30E+04	3.32F+03	2.771E+01	1.022E+01	1.022E+01
562949953328512.0	1.98E+00	2.524E+06	2.568E+06	0.00E+00	6.35E+04	3.36F+03	2.812E+01	1.013E+01	1.013E+01
112589985656024.0	1.96E+00	2.564E+06	2.608E+06	0.00E+00	6.40E+04	3.40F+03	2.853E+01	1.004E+01	1.004E+01
225179971312048.0	1.94E+00	2.604E+06	2.648E+06	0.00E+00	6.45E+04	3.44F+03	2.894E+01	9.95E+00	9.95E+00
450359942624096.0	1.92E+00	2.644E+06	2.688E+06	0.00E+00	6.50E+04	3.48F+03	2.935E+01	9.86E+00	9.86E+00
900719885248192.0	1.90E+00	2.684E+06	2.728E+06	0.00E+00	6.55E+04	3.52F+03	2.976E+01	9.77E+00	9.77E+00
180143977048384.0	1.88E+00	2.724E+06	2.768E+06	0.00E+00	6.60E+04	3.56F+03	3.017E+01	9.68E+00	9.68E+00
360287954096768.0	1.86E+00	2.764E+06	2.808E+06	0.00E+00	6.65E+04	3.60F+03	3.058E+01	9.59E+00	9.59E+00
720575908193536.0	1.84E+00	2.804E+06	2.848E+06	0.00E+00	6.70E+04	3.64F+03	3.099E+01	9.50E+00	9.50E+00
144115181636768.0	1.82E+00	2.844E+06	2.888E+06	0.00E+00	6.75E+04	3.68F+03	3.140E+01	9.41E+00	9.41E+00
288230363273536.0	1.80E+00	2.884E+06	2.928E+06	0.00E+00	6.80E+04	3.72F+03	3.181E+01	9.32E+00	9.32E+00
576460726547072.0	1.78E+00	2.924E+06	2.968E+06	0.00E+00	6.85E+04	3.76F+03	3.222E+01	9.23E+00	9.23E+00
115292145094144.0	1.76E+00	2.964E+06	3.008E+06	0.00E+00	6.90E+04	3.80F+03	3.263E+01	9.14E+00	9.14E+00
230584280188288.0	1.74E+00	3.004E+06	3.048E+06	0.00E+00	6.95E+04	3.84F+03	3.304E+01	9.05E+00	9.05E+00
461168560376576.0	1.72E+00	3.044E+06	3.088E+06	0.00E+00	7.00E+04	3.88F+03	3.345E+01	8.96E+00	8.96E+00
922337120753152.0	1.70E+00	3.084E+06	3.128E+06	0.00E+00	7.05E+04	3.92F+03	3.386E+01	8.87E+00	8.87E+00
1844674241506304.0	1.68E+00	3.124E+06	3.168E+06	0.00E+00	7.10E+04	3.96F+03	3.427E+01	8.78E+00	8.78E+00
3689348483012608.0	1.66E+00	3.164E+06	3.208E+06	0.00E+00	7.15E+04	4.00F+03	3.468E+01	8.69E+00	8.69E+00
7378696966025216.0	1.64E+00	3.204E+06	3.248E+06	0.00E+00	7.20E+04	4.04F+03	3.509E+01	8.60E+00	8.60E+00
1475739393205043.0	1.62E+00	3.244E+06	3.288E+06	0.00E+00	7.25E+04	4.08F+03	3.550E+01	8.51E+00	8.51E+00
2951478786410086.0	1.60E+00	3.284E+06	3.328E+06	0.00E+00	7.30E+04	4.12F+03	3.591E+01	8.42E+00	8.42E+00
5902957572820172.0	1.58E+00	3.324E+06	3.368E+06	0.00E+00	7.35E+04	4.16F+03	3.632E+01	8.33E+00	8.33E+00
1180591514564034.0	1.56E+00	3.364E+06	3.408E+06	0.00E+00	7.40E+04	4.20F+03	3.673E+01	8.24E+00	8.24E+00
2361183029128068.0	1.54E+00	3.404E+06	3.448E+06	0.00E+00	7.45E+04	4.24F+03	3.714E+01	8.15E+00	8.15E+00
4722366058256136.0	1.52E+00	3.444E+06	3.488E+06	0.00E+00	7.50E+04	4.28F+03	3.755E+01	8.06E+00	8.06E+00
9444732116512272.0	1.50E+00	3.484E+06	3.528E+06	0.00E+00	7.55E+04	4.32F+03	3.796E+01	7.97E+00	7.97E+00
1888946423302454.0	1.48E+00	3.524E+06	3.568E+06	0.00E+00	7.60E+04	4.36F+03	3.837E+01	7.88E+00	7.88E+00
3777892846604908.0	1.46E+00	3.564E+06	3.608E+06	0.00E+00	7.65E+04	4.40F+03	3.878E+01	7.79E+00	7.79E+00
7555785693209816.0	1.44E+00	3.604E+06	3.648E+06	0.00E+00	7.70E+04	4.44F+03	3.919E+01	7.70E+00	7.70E+00
1511157138641963.0	1.42E+00	3.644E+06	3.688E+06	0.00E+00	7.75E+04	4.48F+03	3.960E+01	7.61E+00	7.61E+00
3022314277283926.0	1.40E+00	3.684E+06	3.728E+06	0.00E+00	7.80E+04	4.52F+03	4.001E+01	7.52E+00	7.52E+00
6044628554567852.0	1.38E+00	3.724E+06							

Table 11d

LEAD

Atomic Collisions, Pair Productions, and Bremsstrahlungs

F	P	DE/DX-TOT	RANGE	COLLISION	PAIR PROD	BREMSTRAL	NUCLEAR
(GeV)	(GeV/c)	(MeV/GM/CM50)	(cm)	(ft)	(all TN 4EV/CH/CM50)		
.580E+03	.580E+03	.111E+02	.122E+06	.107E+05	.352E+03	.192E+01	.440E+01
.600E+03	.600E+03	.114E+02	.124E+06	.109E+05	.357E+03	.193E+01	.456E+01
.620E+03	.620E+03	.117E+02	.126E+06	.110E+05	.362E+03	.193E+01	.472E+01
.640E+03	.640E+03	.121E+02	.127E+06	.112E+05	.367E+03	.193E+01	.488E+01
.660E+03	.660E+03	.124E+02	.129E+06	.113E+05	.371E+03	.193E+01	.504E+01
.680E+03	.680E+03	.128E+02	.131E+06	.115E+05	.376E+03	.193E+01	.547E+01
.700E+03	.700E+03	.131E+02	.132E+06	.117E+05	.380E+03	.194E+01	.520E+01
.720E+03	.720E+03	.135E+02	.134E+06	.117E+05	.385E+03	.194E+01	.552E+01
.740E+03	.740E+03	.138E+02	.135E+06	.119E+05	.389E+03	.194E+01	.568E+01
.760E+03	.760E+03	.142E+02	.137E+06	.120E+05	.393E+03	.194E+01	.584E+01
.780E+03	.780E+03	.145E+02	.139E+06	.121E+05	.397E+03	.194E+01	.600E+01
.800E+03	.800E+03	.149E+02	.139E+06	.122E+05	.401E+03	.194E+01	.616E+01
.820E+03	.820E+03	.153E+02	.141E+06	.123E+05	.405E+03	.195E+01	.632E+01
.840E+03	.840E+03	.156E+02	.142E+06	.125E+05	.409E+03	.195E+01	.648E+01
.860E+03	.860E+03	.160E+02	.143E+06	.126E+05	.412E+03	.195E+01	.664E+01
.880E+03	.880E+03	.163E+02	.144E+06	.127E+05	.416E+03	.195E+01	.680E+01
.900E+03	.900E+03	.167E+02	.145E+06	.128E+05	.419E+03	.195E+01	.697E+01
.920E+03	.920E+03	.170E+02	.147E+06	.129E+05	.423E+03	.195E+01	.713E+01
.940E+03	.940E+03	.174E+02	.148E+06	.130E+05	.426E+03	.195E+01	.729E+01
.960E+03	.960E+03	.177E+02	.149E+06	.131E+05	.429E+03	.196E+01	.745E+01
.980E+03	.980E+03	.181E+02	.150E+06	.132E+05	.432E+03	.196E+01	.761E+01
.100E+04	.100E+04	.185E+02	.151E+06	.133E+05	.436E+03	.196E+01	.777E+01
.102E+04	.102E+04	.189E+02	.152E+06	.134E+05	.439E+03	.196E+01	.794E+01
.104E+04	.104E+04	.192E+02	.154E+06	.135E+05	.442E+03	.196E+01	.811E+01
.106E+04	.106E+04	.196E+02	.155E+06	.136E+05	.445E+03	.196E+01	.829E+01
.108E+04	.108E+04	.200E+02	.156E+06	.137E+05	.449E+03	.196E+01	.846E+01
.110E+04	.110E+04	.204E+02	.157E+06	.138E+05	.452E+03	.196E+01	.865E+01

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Table 12a

URANIUM Atomic Collisions, Pair Productions, and Bremsstrahlungs

Table 12b

Atomic Collisions, Pair Productions, and Bremsstrahlungs

Table 12c

URANIUM
Atomic Collisions, Pair Productions, and Bremsstrahlungs

RANGE		COLLISION (ALL PAIR PRODUCTION/PAIR STR)		NUCLEAR	
F	(GeV/CMS)	(GeV/CMS)	(GeV/CMS)	(GeV/CMS)	(GeV/CMS)
P	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)
F	(GeV)	(GeV)	(GeV)	(GeV)	(GeV)
NF/NX-TOT	(NF/V/CMS)	(NF/V/CMS)	(NF/V/CMS)	(NF/V/CMS)	(NF/V/CMS)
R	(CM)	(CM)	(CM)	(CM)	(CM)
D	(EVE)	(EVE)	(EVE)	(EVE)	(EVE)
NUCLEAR	(HEV/GM/CHS0)	(HEV/GM/CHS0)	(HEV/GM/CHS0)	(HEV/GM/CHS0)	(HEV/GM/CHS0)

Table 12d

URANIUM
Atomic Collisions, Pair Productions, and Bremsstrahlungs

F	P	DF/DX-TOT (HFV/C4/C4SQ)	RANGE (CM)	COLLISION PAIR (ALL IN MEV/CM/GMSQ)		DF/DX-PARTIAL NUCLEAR
				(FT)	(OPEN STRAL)	
5.00E+03	5.00E+03	1.14E+02	6.27E+04	2.06E+03	1.85E+01	4.23E+00
5.00E+03	5.00E+03	1.25E+02	6.37E+04	2.09E+03	1.95E+01	4.39E+00
5.00E+03	5.00E+03	1.26E+02	6.44E+04	2.11E+03	1.86E+01	4.57E+00
5.00E+03	5.00E+03	1.29E+02	6.52E+04	2.14E+03	1.86E+01	4.67E+00
5.00E+03	5.00E+03	1.33E+02	6.60E+04	2.17E+03	1.86E+01	4.87E+00
5.00E+03	5.00E+03	1.37E+02	6.68E+04	2.20E+03	1.86E+01	4.96E+00
5.00E+03	5.00E+03	1.41E+02	6.75E+04	2.24E+03	1.86E+01	5.11E+00
5.00E+03	5.00E+03	1.44E+02	6.83E+04	2.27E+03	1.87E+01	5.26E+00
5.00E+03	5.00E+03	1.48E+02	6.90E+04	2.31E+03	1.87E+01	5.40E+00
5.00E+03	5.00E+03	1.52E+02	6.98E+04	2.34E+03	1.87E+01	5.54E+00
5.00E+03	5.00E+03	1.56E+02	7.05E+04	2.37E+03	1.87E+01	5.69E+00
5.00E+03	5.00E+03	1.60E+02	7.12E+04	2.41E+03	1.87E+01	5.84E+00
5.00E+03	5.00E+03	1.64E+02	7.19E+04	2.44E+03	1.87E+01	6.00E+00
5.00E+03	5.00E+03	1.67E+02	7.26E+04	2.47E+03	1.87E+01	6.15E+00
5.00E+03	5.00E+03	1.71E+02	7.33E+04	2.51E+03	1.87E+01	6.30E+00
5.00E+03	5.00E+03	1.74E+02	7.40E+04	2.54E+03	1.87E+01	6.45E+00
5.00E+03	5.00E+03	1.78E+02	7.47E+04	2.57E+03	1.87E+01	6.60E+00
5.00E+03	5.00E+03	1.82E+02	7.54E+04	2.61E+03	1.87E+01	6.75E+00
5.00E+03	5.00E+03	1.86E+02	7.61E+04	2.64E+03	1.87E+01	6.90E+00
5.00E+03	5.00E+03	1.90E+02	7.68E+04	2.67E+03	1.87E+01	7.05E+00
5.00E+03	5.00E+03	1.94E+02	7.75E+04	2.71E+03	1.87E+01	7.20E+00
5.00E+03	5.00E+03	1.98E+02	7.82E+04	2.74E+03	1.87E+01	7.35E+00
5.00E+03	5.00E+03	2.02E+02	7.89E+04	2.77E+03	1.87E+01	7.50E+00
5.00E+03	5.00E+03	2.06E+02	7.96E+04	2.81E+03	1.87E+01	7.65E+00
5.00E+03	5.00E+03	2.10E+02	8.03E+04	2.84E+03	1.87E+01	7.80E+00
5.00E+03	5.00E+03	2.14E+02	8.10E+04	2.87E+03	1.87E+01	7.95E+00
5.00E+03	5.00E+03	2.18E+02	8.17E+04	2.91E+03	1.87E+01	8.10E+00
5.00E+03	5.00E+03	2.22E+02	8.24E+04	2.94E+03	1.87E+01	8.25E+00
5.00E+03	5.00E+03	2.26E+02	8.31E+04	2.97E+03	1.87E+01	8.40E+00
5.00E+03	5.00E+03	2.30E+02	8.38E+04	3.01E+03	1.87E+01	8.55E+00
5.00E+03	5.00E+03	2.34E+02	8.45E+04	3.04E+03	1.87E+01	8.70E+00
5.00E+03	5.00E+03	2.38E+02	8.52E+04	3.07E+03	1.87E+01	8.85E+00
5.00E+03	5.00E+03	2.42E+02	8.59E+04	3.11E+03	1.87E+01	9.00E+00
5.00E+03	5.00E+03	2.46E+02	8.66E+04	3.14E+03	1.87E+01	9.15E+00
5.00E+03	5.00E+03	2.50E+02	8.73E+04	3.17E+03	1.87E+01	9.30E+00
5.00E+03	5.00E+03	2.54E+02	8.80E+04	3.21E+03	1.87E+01	9.45E+00
5.00E+03	5.00E+03	2.58E+02	8.87E+04	3.24E+03	1.87E+01	9.60E+00
5.00E+03	5.00E+03	2.62E+02	8.94E+04	3.27E+03	1.87E+01	9.75E+00
5.00E+03	5.00E+03	2.66E+02	9.01E+04	3.31E+03	1.87E+01	9.90E+00
5.00E+03	5.00E+03	2.70E+02	9.08E+04	3.34E+03	1.87E+01	1.00E+01
5.00E+03	5.00E+03	2.74E+02	9.15E+04	3.37E+03	1.87E+01	1.04E+01
5.00E+03	5.00E+03	2.78E+02	9.22E+04	3.41E+03	1.87E+01	1.07E+01
5.00E+03	5.00E+03	2.82E+02	9.29E+04	3.44E+03	1.87E+01	1.10E+01
5.00E+03	5.00E+03	2.86E+02	9.36E+04	3.47E+03	1.87E+01	1.13E+01
5.00E+03	5.00E+03	2.90E+02	9.43E+04	3.51E+03	1.87E+01	1.16E+01
5.00E+03	5.00E+03	2.94E+02	9.50E+04	3.54E+03	1.87E+01	1.19E+01
5.00E+03	5.00E+03	2.98E+02	9.57E+04	3.57E+03	1.87E+01	1.22E+01
5.00E+03	5.00E+03	3.02E+02	9.64E+04	3.61E+03	1.87E+01	1.25E+01
5.00E+03	5.00E+03	3.06E+02	9.71E+04	3.64E+03	1.87E+01	1.28E+01
5.00E+03	5.00E+03	3.10E+02	9.78E+04	3.67E+03	1.87E+01	1.31E+01
5.00E+03	5.00E+03	3.14E+02	9.85E+04	3.71E+03	1.87E+01	1.34E+01
5.00E+03	5.00E+03	3.18E+02	9.92E+04	3.74E+03	1.87E+01	1.37E+01
5.00E+03	5.00E+03	3.22E+02	1.00E+05	3.77E+03	1.87E+01	1.40E+01
5.00E+03	5.00E+03	3.26E+02	1.02E+05	3.80E+03	1.87E+01	1.43E+01
5.00E+03	5.00E+03	3.30E+02	1.04E+05	3.83E+03	1.87E+01	1.46E+01
5.00E+03	5.00E+03	3.34E+02	1.06E+05	3.86E+03	1.87E+01	1.49E+01
5.00E+03	5.00E+03	3.38E+02	1.08E+05	3.89E+03	1.87E+01	1.52E+01
5.00E+03	5.00E+03	3.42E+02	1.10E+05	3.92E+03	1.87E+01	1.55E+01
5.00E+03	5.00E+03	3.46E+02	1.12E+05	3.95E+03	1.87E+01	1.58E+01
5.00E+03	5.00E+03	3.50E+02	1.14E+05	3.98E+03	1.87E+01	1.61E+01
5.00E+03	5.00E+03	3.54E+02	1.16E+05	4.01E+03	1.87E+01	1.64E+01
5.00E+03	5.00E+03	3.58E+02	1.18E+05	4.04E+03	1.87E+01	1.67E+01
5.00E+03	5.00E+03	3.62E+02	1.20E+05	4.07E+03	1.87E+01	1.70E+01
5.00E+03	5.00E+03	3.66E+02	1.22E+05	4.10E+03	1.87E+01	1.73E+01
5.00E+03	5.00E+03	3.70E+02	1.24E+05	4.13E+03	1.87E+01	1.76E+01
5.00E+03	5.00E+03	3.74E+02	1.26E+05	4.16E+03	1.87E+01	1.79E+01
5.00E+03	5.00E+03	3.78E+02	1.28E+05	4.19E+03	1.87E+01	1.82E+01
5.00E+03	5.00E+03	3.82E+02	1.30E+05	4.22E+03	1.87E+01	1.85E+01
5.00E+03	5.00E+03	3.86E+02	1.32E+05	4.25E+03	1.87E+01	1.88E+01
5.00E+03	5.00E+03	3.90E+02	1.34E+05	4.28E+03	1.87E+01	1.91E+01
5.00E+03	5.00E+03	3.94E+02	1.36E+05	4.31E+03	1.87E+01	1.94E+01
5.00E+03	5.00E+03	3.98E+02	1.38E+05	4.34E+03	1.87E+01	1.97E+01
5.00E+03	5.00E+03	4.02E+02	1.40E+05	4.37E+03	1.87E+01	2.00E+01
5.00E+03	5.00E+03	4.06E+02	1.42E+05	4.40E+03	1.87E+01	2.03E+01
5.00E+03	5.00E+03	4.10E+02	1.44E+05	4.43E+03	1.87E+01	2.06E+01
5.00E+03	5.00E+03	4.14E+02	1.46E+05	4.46E+03	1.87E+01	2.09E+01
5.00E+03	5.00E+03	4.18E+02	1.48E+05	4.49E+03	1.87E+01	2.12E+01
5.00E+03	5.00E+03	4.22E+02	1.50E+05	4.52E+03	1.87E+01	2.15E+01
5.00E+03	5.00E+03	4.26E+02	1.52E+05	4.55E+03	1.87E+01	2.18E+01
5.00E+03	5.00E+03	4.30E+02	1.54E+05	4.58E+03	1.87E+01	2.21E+01
5.00E+03	5.00E+03	4.34E+02	1.56E+05	4.61E+03	1.87E+01	2.24E+01
5.00E+03	5.00E+03	4.38E+02	1.58E+05	4.64E+03	1.87E+01	2.27E+01
5.00E+03	5.00E+03	4.42E+02	1.60E+05	4.67E+03	1.87E+01	2.30E+01
5.00E+03	5.00E+03	4.46E+02	1.62E+05	4.70E+03	1.87E+01	2.33E+01
5.00E+03	5.00E+03	4.50E+02	1.64E+05	4.73E+03	1.87E+01	2.36E+01
5.00E+03	5.00E+03	4.54E+02	1.66E+05	4.76E+03	1.87E+01	2.39E+01
5.00E+03	5.00E+03	4.58E+02	1.68E+05	4.79E+03	1.87E+01	2.42E+01
5.00E+03	5.00E+03	4.62E+02	1.70E+05	4.82E+03	1.87E+01	2.45E+01
5.00E+03	5.00E+03	4.66E+02	1.72E+05	4.85E+03	1.87E+01	2.48E+01
5.00E+03	5.00E+03	4.70E+02	1.74E+05	4.88E+03	1.87E+01	2.51E+01
5.00E+03	5.00E+03	4.74E+02	1.76E+05	4.91E+03	1.87E+01	2.54E+01
5.00E+03	5.00E+03	4.78E+02	1.78E+05	4.94E+03	1.87E+01	2.57E+01
5.00E+03	5.00E+03	4.82E+02	1.80E+05	4.97E+03	1.87E+01	2.60E+01
5.00E+03	5.00E+03	4.86E+02	1.82E+05	5.00E+03	1.87E+01	2.63E+01
5.00E+03	5.00E+03	4.90E+02	1.84E+05	5.03E+03	1.87E+01	2.66E+01
5.00E+03	5.00E+03	4.94E+02	1.86E+05	5.06E+03	1.87E+01	2.69E+01
5.00E+03	5.00E+03	4.98E+02	1.88E+05	5.09E+03	1.87E+01	2.72E+01
5.00E+03	5.00E+03	5.02E+02	1.90E+05	5.12E+03	1.87E+01	2.75E+01
5.00E+03	5.00E+03	5.06E+02	1.92E+05	5.15E+03	1.87E+01	2.78E+01
5.00E+03	5.00E+03	5.10E+02	1.94E+05	5.18E+03	1.87E+01	2.81E+01
5.00E+03	5.00E+03	5.14E+02	1.96E+05	5.21E+03	1.87E+01	2.84E+01
5.00E+03	5.00E+03	5.18E+02	1.98E+05	5.24E+03	1.87E+01	2.87E+01
5.00E+03	5.00E+03	5.22E+02	2.00E+05	5.27E+03	1.87E+01	2.90E+01
5.00E+03	5.00E+03	5.26E+02	2.02E+05	5.30E+03	1.87E+01	2.93E+01
5.00E+03	5.00E+03	5.30E+02	2.04E+05	5.33E+03	1.87E+01	2.96E+01
5.00E+03	5.00E+03	5.34E+02	2.06E+05	5.36E+03	1.87E+01	2.99E+01
5.00E+03	5.00E+03	5.38E+02	2.08E+05	5.39E+03	1.87E+01	3.02E+01
5.00E+03	5.00E+03	5.42E+02	2.10E+05	5.42E+03	1.87E+01	3.05E+01
5.00E+03	5.00E+03	5.46E+02	2.12E+05	5.45E+03	1.87E+01	3.08E+01
5.00E+03	5.00E+03	5.50E+02	2.14E+05	5.48E+03	1.87E+01	3.11E+01
5.00E+03	5.00E+03	5.54E+02	2.16E+05	5.51E+03	1.87E+01	3.14E+01
5.00E						

Table 13a

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

TRON

Table 13b

IRON

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

P. (GeV/C)	D ₁ /D ₀ X-TOT (GeV/C ² cm ⁻²)	(GeV/C ² cm ⁻²)	RANGE (CM)	COLLISION (ALL IN NUCLEAR)		PAIR PRODUCTION		PARTIAL ERI (CHS)		NUCLEAR	
				(FT)	(FT)	(FT)	(FT)	(FT)	(FT)	(FT)	(FT)
1.0	1.74E+01	1.74E+01	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2.0	1.75E+01	1.75E+01	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.0	1.76E+01	1.76E+01	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4.0	1.77E+01	1.77E+01	4.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5.0	1.78E+01	1.78E+01	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6.0	1.79E+01	1.79E+01	6.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7.0	1.80E+01	1.80E+01	7.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
8.0	1.81E+01	1.81E+01	8.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9.0	1.82E+01	1.82E+01	9.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10.0	1.83E+01	1.83E+01	10.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12.0	1.84E+01	1.84E+01	12.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15.0	1.85E+01	1.85E+01	15.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20.0	1.86E+01	1.86E+01	20.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30.0	1.87E+01	1.87E+01	30.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50.0	1.88E+01	1.88E+01	50.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
70.0	1.89E+01	1.89E+01	70.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100.0	1.90E+01	1.90E+01	100.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
150.0	1.91E+01	1.91E+01	150.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
200.0	1.92E+01	1.92E+01	200.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
300.0	1.93E+01	1.93E+01	300.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
500.0	1.94E+01	1.94E+01	500.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
700.0	1.95E+01	1.95E+01	700.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1000.0	1.96E+01	1.96E+01	1000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1500.0	1.97E+01	1.97E+01	1500.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2000.0	1.98E+01	1.98E+01	2000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000.0	1.99E+01	1.99E+01	3000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5000.0	2.00E+01	2.00E+01	5000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7000.0	2.01E+01	2.01E+01	7000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10000.0	2.02E+01	2.02E+01	10000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15000.0	2.03E+01	2.03E+01	15000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20000.0	2.04E+01	2.04E+01	20000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30000.0	2.05E+01	2.05E+01	30000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50000.0	2.06E+01	2.06E+01	50000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
70000.0	2.07E+01	2.07E+01	70000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100000.0	2.08E+01	2.08E+01	100000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
150000.0	2.09E+01	2.09E+01	150000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
200000.0	2.10E+01	2.10E+01	200000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
300000.0	2.11E+01	2.11E+01	300000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
500000.0	2.12E+01	2.12E+01	500000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
700000.0	2.13E+01	2.13E+01	700000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1000000.0	2.14E+01	2.14E+01	1000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1500000.0	2.15E+01	2.15E+01	1500000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2000000.0	2.16E+01	2.16E+01	2000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000000.0	2.17E+01	2.17E+01	3000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5000000.0	2.18E+01	2.18E+01	5000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7000000.0	2.19E+01	2.19E+01	7000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10000000.0	2.20E+01	2.20E+01	10000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15000000.0	2.21E+01	2.21E+01	15000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20000000.0	2.22E+01	2.22E+01	20000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30000000.0	2.23E+01	2.23E+01	30000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50000000.0	2.24E+01	2.24E+01	50000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
70000000.0	2.25E+01	2.25E+01	70000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100000000.0	2.26E+01	2.26E+01	100000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
150000000.0	2.27E+01	2.27E+01	150000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
200000000.0	2.28E+01	2.28E+01	200000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
300000000.0	2.29E+01	2.29E+01	300000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
500000000.0	2.30E+01	2.30E+01	500000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
700000000.0	2.31E+01	2.31E+01	700000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1000000000.0	2.32E+01	2.32E+01	1000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1500000000.0	2.33E+01	2.33E+01	1500000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2000000000.0	2.34E+01	2.34E+01	2000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000000000.0	2.35E+01	2.35E+01	3000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5000000000.0	2.36E+01	2.36E+01	5000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7000000000.0	2.37E+01	2.37E+01	7000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10000000000.0	2.38E+01	2.38E+01	10000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15000000000.0	2.39E+01	2.39E+01	15000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20000000000.0	2.40E+01	2.40E+01	20000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30000000000.0	2.41E+01	2.41E+01	30000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
50000000000.0	2.42E+01	2.42E+01	50000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
70000000000.0	2.43E+01	2.43E+01	70000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
100000000000.0	2.44E+01	2.44E+01	100000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
150000000000.0	2.45E+01	2.45E+01	150000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
200000000000.0	2.46E+01	2.46E+01	200000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
300000000000.0	2.47E+01	2.47E+01	300000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
500000000000.0	2.48E+01	2.48E+01	500000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
700000000000.0	2.49E+01	2.49E+01	700000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1000000000000.0	2.50E+01	2.50E+01	1000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
1500000000000.0	2.51E+01	2.51E+01	1500000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2000000000000.0	2.52E+01	2.52E+01	2000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3000000000000.0	2.53E+01	2.53E+01	3000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
5000000000000.0	2.54E+01	2.54E+01	5000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7000000000000.0	2.55E+01	2.55E+01	7000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10000000000000.0	2.56E+01	2.56E+01	10000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15000000000000.0	2.57E+01	2.57E+01	15000000000000.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
20000000000000.0	2.58E+01	2.58E+01	20000000000000.0	1.0	1.0	1.0					

Table 13c

IRON

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

E (GeV)	E/ϵ_X (GeV/C)	ϵ_X (GeV/C)	RANGE (CM)	COLLISION (ALL)	PAIR PROD./PARTIAL E=0.05 MeV/CHSO	NUCLEAR
2	2.0	0.01	1.66E+01	1.66E+01	1.66E+01	1.66E+01
3	3.0	0.01	2.14E+01	2.14E+01	2.14E+01	2.14E+01
4	4.0	0.01	2.71E+01	2.71E+01	2.71E+01	2.71E+01
5	5.0	0.01	3.32E+01	3.32E+01	3.32E+01	3.32E+01
6	6.0	0.01	3.92E+01	3.92E+01	3.92E+01	3.92E+01
7	7.0	0.01	4.52E+01	4.52E+01	4.52E+01	4.52E+01
8	8.0	0.01	5.12E+01	5.12E+01	5.12E+01	5.12E+01
9	9.0	0.01	5.72E+01	5.72E+01	5.72E+01	5.72E+01
10	10.0	0.01	6.32E+01	6.32E+01	6.32E+01	6.32E+01
12	12.0	0.01	7.68E+01	7.68E+01	7.68E+01	7.68E+01
15	15.0	0.01	1.02E+02	1.02E+02	1.02E+02	1.02E+02
20	20.0	0.01	1.53E+02	1.53E+02	1.53E+02	1.53E+02
30	30.0	0.01	2.30E+02	2.30E+02	2.30E+02	2.30E+02
50	50.0	0.01	3.83E+02	3.83E+02	3.83E+02	3.83E+02
80	80.0	0.01	6.33E+02	6.33E+02	6.33E+02	6.33E+02
120	120.0	0.01	1.05E+03	1.05E+03	1.05E+03	1.05E+03
200	200.0	0.01	1.75E+03	1.75E+03	1.75E+03	1.75E+03
300	300.0	0.01	2.67E+03	2.67E+03	2.67E+03	2.67E+03
500	500.0	0.01	4.45E+03	4.45E+03	4.45E+03	4.45E+03
800	800.0	0.01	7.38E+03	7.38E+03	7.38E+03	7.38E+03
1200	1200.0	0.01	1.18E+04	1.18E+04	1.18E+04	1.18E+04
2000	2000.0	0.01	1.97E+04	1.97E+04	1.97E+04	1.97E+04
3000	3000.0	0.01	3.00E+04	3.00E+04	3.00E+04	3.00E+04
5000	5000.0	0.01	5.00E+04	5.00E+04	5.00E+04	5.00E+04
8000	8000.0	0.01	7.67E+04	7.67E+04	7.67E+04	7.67E+04
12000	12000.0	0.01	1.15E+05	1.15E+05	1.15E+05	1.15E+05
20000	20000.0	0.01	1.88E+05	1.88E+05	1.88E+05	1.88E+05
30000	30000.0	0.01	2.88E+05	2.88E+05	2.88E+05	2.88E+05
50000	50000.0	0.01	4.77E+05	4.77E+05	4.77E+05	4.77E+05
80000	80000.0	0.01	7.67E+05	7.67E+05	7.67E+05	7.67E+05
120000	120000.0	0.01	1.15E+06	1.15E+06	1.15E+06	1.15E+06
200000	200000.0	0.01	1.88E+06	1.88E+06	1.88E+06	1.88E+06
300000	300000.0	0.01	2.88E+06	2.88E+06	2.88E+06	2.88E+06
500000	500000.0	0.01	4.77E+06	4.77E+06	4.77E+06	4.77E+06
800000	800000.0	0.01	7.67E+06	7.67E+06	7.67E+06	7.67E+06
1200000	1200000.0	0.01	1.15E+07	1.15E+07	1.15E+07	1.15E+07
2000000	2000000.0	0.01	1.88E+07	1.88E+07	1.88E+07	1.88E+07
3000000	3000000.0	0.01	2.88E+07	2.88E+07	2.88E+07	2.88E+07
5000000	5000000.0	0.01	4.77E+07	4.77E+07	4.77E+07	4.77E+07
8000000	8000000.0	0.01	7.67E+07	7.67E+07	7.67E+07	7.67E+07
12000000	12000000.0	0.01	1.15E+08	1.15E+08	1.15E+08	1.15E+08
20000000	20000000.0	0.01	1.88E+08	1.88E+08	1.88E+08	1.88E+08
30000000	30000000.0	0.01	2.88E+08	2.88E+08	2.88E+08	2.88E+08
50000000	50000000.0	0.01	4.77E+08	4.77E+08	4.77E+08	4.77E+08
80000000	80000000.0	0.01	7.67E+08	7.67E+08	7.67E+08	7.67E+08
120000000	120000000.0	0.01	1.15E+09	1.15E+09	1.15E+09	1.15E+09
200000000	200000000.0	0.01	1.88E+09	1.88E+09	1.88E+09	1.88E+09
300000000	300000000.0	0.01	2.88E+09	2.88E+09	2.88E+09	2.88E+09
500000000	500000000.0	0.01	4.77E+09	4.77E+09	4.77E+09	4.77E+09
800000000	800000000.0	0.01	7.67E+09	7.67E+09	7.67E+09	7.67E+09
1200000000	1200000000.0	0.01	1.15E+10	1.15E+10	1.15E+10	1.15E+10
2000000000	2000000000.0	0.01	1.88E+10	1.88E+10	1.88E+10	1.88E+10
3000000000	3000000000.0	0.01	2.88E+10	2.88E+10	2.88E+10	2.88E+10
5000000000	5000000000.0	0.01	4.77E+10	4.77E+10	4.77E+10	4.77E+10
8000000000	8000000000.0	0.01	7.67E+10	7.67E+10	7.67E+10	7.67E+10
12000000000	12000000000.0	0.01	1.15E+11	1.15E+11	1.15E+11	1.15E+11
20000000000	20000000000.0	0.01	1.88E+11	1.88E+11	1.88E+11	1.88E+11
30000000000	30000000000.0	0.01	2.88E+11	2.88E+11	2.88E+11	2.88E+11
50000000000	50000000000.0	0.01	4.77E+11	4.77E+11	4.77E+11	4.77E+11
80000000000	80000000000.0	0.01	7.67E+11	7.67E+11	7.67E+11	7.67E+11
120000000000	120000000000.0	0.01	1.15E+12	1.15E+12	1.15E+12	1.15E+12
200000000000	200000000000.0	0.01	1.88E+12	1.88E+12	1.88E+12	1.88E+12
300000000000	300000000000.0	0.01	2.88E+12	2.88E+12	2.88E+12	2.88E+12
500000000000	500000000000.0	0.01	4.77E+12	4.77E+12	4.77E+12	4.77E+12
800000000000	800000000000.0	0.01	7.67E+12	7.67E+12	7.67E+12	7.67E+12
1200000000000	1200000000000.0	0.01	1.15E+13	1.15E+13	1.15E+13	1.15E+13
2000000000000	2000000000000.0	0.01	1.88E+13	1.88E+13	1.88E+13	1.88E+13
3000000000000	3000000000000.0	0.01	2.88E+13	2.88E+13	2.88E+13	2.88E+13
5000000000000	5000000000000.0	0.01	4.77E+13	4.77E+13	4.77E+13	4.77E+13
8000000000000	8000000000000.0	0.01	7.67E+13	7.67E+13	7.67E+13	7.67E+13
12000000000000	12000000000000.0	0.01	1.15E+14	1.15E+14	1.15E+14	1.15E+14
20000000000000	20000000000000.0	0.01	1.88E+14	1.88E+14	1.88E+14	1.88E+14
30000000000000	30000000000000.0	0.01	2.88E+14	2.88E+14	2.88E+14	2.88E+14
50000000000000	50000000000000.0	0.01	4.77E+14	4.77E+14	4.77E+14	4.77E+14
80000000000000	80000000000000.0	0.01	7.67E+14	7.67E+14	7.67E+14	7.67E+14
120000000000000	120000000000000.0	0.01	1.15E+15	1.15E+15	1.15E+15	1.15E+15
200000000000000	200000000000000.0	0.01	1.88E+15	1.88E+15	1.88E+15	1.88E+15
300000000000000	300000000000000.0	0.01	2.88E+15	2.88E+15	2.88E+15	2.88E+15
500000000000000	500000000000000.0	0.01	4.77E+15	4.77E+15	4.77E+15	4.77E+15
800000000000000	800000000000000.0	0.01	7.67E+15	7.67E+15	7.67E+15	7.67E+15
1200000000000000	1200000000000000.0	0.01	1.15E+16	1.15E+16	1.15E+16	1.15E+16
2000000000000000	2000000000000000.0	0.01	1.88E+16	1.88E+16	1.88E+16	1.88E+16
3000000000000000	3000000000000000.0	0.01	2.88E+16	2.88E+16	2.88E+16	2.88E+16
5000000000000000	5000000000000000.0	0.01	4.77E+16	4.77E+16	4.77E+16	4.77E+16
8000000000000000	8000000000000000.0	0.01	7.67E+16	7.67E+16	7.67E+16	7.67E+16
12000000000000000	12000000000000000.0	0.01	1.15E+17	1.15E+17	1.15E+17	1.15E+17
20000000000000000	20000000000000000.0	0.01	1.88E+17	1.88E+17	1.88E+17	1.88E+17
30000000000000000	30000000000000000.0	0.01	2.88E+17	2.88E+17	2.88E+17	2.88E+17
50000000000000000	50000000000000000.0	0.01	4.77E+17	4.77E+17	4.77E+17	4.77E+17
80000000000000000	80000000000000000.0	0.01	7.67E+17	7.67E+17	7.67E+17	7.67E+17
120000000000000000	120000000000000000.0	0.01	1.15E+18	1.15E+18	1.15E+18	1.15E+18
200000000000000000	200000000000000000.0	0.01	1.88E+18	1.88E+18	1.88E+18	1.88E+18
300000000000000000	300000000000000000.0	0.01	2.88E+18	2.88E+18	2.88E+18	2.88E+18
500000000000000000	500000000000000000.0	0.01	4.77E+18	4.77E+18	4.77E+18	4.77E+18
800000000000000000	800000000000000000.0	0.01	7.67E+18	7.67E+18	7.67E+18	7.67E+18
1200000000000000000	1200000000000000000.0	0.01	1.15E+19	1.15E+19	1.15E+19	1.15E+19
2000000000000000000	2000000000000000000.0	0.01	1.88E+19	1.88E+19	1.88E+19	1.88E+19
3000000000000000000	3000000000000000000.0	0.01	2.88E+19	2.88E+19	2.88E+19	2.88E+19
5000000000000000000	5000000000000000000.0	0.01	4.77E+19	4.77E+19	4.77E+19	4.77E+19
8000000000000000000	8000000000000000000.0	0.01	7.67E+19	7.67E+19	7.67E+19	7.67E+19
12000000000000000000	1200000000000000000.0	0.01	1.15E+20	1.15E+20	1.15E+20	1.15E+20
20000000000000000000	2000000000000000000.0	0.01	1.88E+20	1.88E+20	1.88E+20	1.88E+20
30000000000000000000	3000000000000000000.0	0.01	2.88E+20	2.88E+20	2.88E+20	2.88E+20
50000000000000000000	5000000000000000000.0	0.01	4.77E+20	4.77E+20	4.77E+20	4.77E+20
80000000000000000000	8000000000000000000.0	0.01	7.67E+20	7.67E+20	7.67E+20	7.67E+20
120000000000000000000	1200000000000000000.0	0.01	1.15E+21	1.15E+21	1.15E+21	1.15E+21
200000000000000000000	2000000000000000000.0	0.01	1.88E+21	1.88E+21	1.88E+21	1.88E+21
300000000000000000000	3000000000000000000.0	0.01	2.88E+21	2.88E+21	2.88E+21	2.88E+21
500000000000000000000	5000000000000000000.0	0.01	4.77E+21	4.77E+21	4.77E+21	4.77E+21
800						

Table 13d

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Table 14a

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Table 14b

SOIL

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

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TM-786

E (GeV)	P (GeV/c)	DF/DX-TOT (MeV/c/GMSQ)	RANGE (GeV)	COLLISION (FT)	PAIR PROD (ALL IN MeV/GM/CMSQ)	DF/DX-PARTIAL PREMSTPAI	NUCLEAR
24.0E+01	.250E+01	.184E+01	.134E+04	.670E+03	.220E+02	.309E+03	.111E+02
.260E+01	.270E+01	.190E+01	.145E+04	.723E+03	.237E+02	.189E+01	.413E+03
.287E+01	.299E+01	.191E+01	.155E+04	.775E+03	.254E+02	.190E+01	.523E+03
.310E+01	.310E+01	.192E+01	.166E+04	.828E+03	.272E+02	.191E+01	.638E+03
.329E+01	.330E+01	.193E+01	.176E+04	.880E+03	.289E+02	.192E+01	.753E+03
.340E+01	.350E+01	.194E+01	.186E+04	.932E+03	.306E+02	.193E+01	.882E+03
.360E+01	.370E+01	.195E+01	.197E+04	.983E+03	.323E+02	.194E+01	.101E+02
.390E+01	.410E+01	.196E+01	.207E+04	.103E+04	.341E+02	.195E+01	.114E+02
.410E+01	.410E+01	.197E+01	.217E+04	.109E+04	.356E+02	.196E+01	.128E+02
.442E+01	.445E+01	.198E+01	.227E+04	.114E+04	.373E+02	.196E+01	.142E+02
.446E+01	.450E+01	.199E+01	.237E+04	.119E+04	.386E+02	.197E+01	.157E+02
.470E+01	.470E+01	.200E+01	.248E+04	.124E+04	.406E+02	.197E+01	.172E+02
.490E+01	.490E+01	.201E+01	.258E+04	.129E+04	.423E+02	.199E+01	.187E+02
.510E+01	.510E+01	.202E+01	.268E+04	.134E+04	.443E+02	.199E+01	.202E+02
.550E+01	.550E+01	.203E+01	.293E+04	.145E+04	.480E+02	.200E+01	.242E+02
.560E+01	.560E+01	.204E+01	.317E+04	.159E+04	.521E+02	.201E+01	.284E+02
.610E+01	.610E+01	.205E+01	.342E+04	.171E+04	.560E+02	.202E+01	.327E+02
.650E+01	.650E+01	.206E+01	.357E+04	.183E+04	.601E+02	.203E+01	.371E+02
.710E+01	.710E+01	.207E+01	.391E+04	.196E+04	.641E+02	.204E+01	.417E+02
.810E+01	.810E+01	.208E+01	.415E+04	.208E+04	.681E+02	.205E+01	.464E+02
.910E+01	.910E+01	.209E+01	.460E+04	.220E+04	.721E+02	.206E+01	.513E+02
.950E+01	.950E+01	.210E+01	.483E+04	.224E+04	.760E+02	.207E+01	.562E+02
.110E+02	.111E+02	.211E+01	.511E+04	.245E+04	.800E+02	.208E+01	.608E+02
.112E+02	.112E+02	.212E+01	.559E+04	.280E+04	.917E+02	.209E+01	.650E+02
.113E+02	.113E+02	.213E+01	.606E+04	.303E+04	.955E+02	.210E+01	.694E+02
.114E+02	.114E+02	.214E+01	.653E+04	.327E+04	.1017E+03	.211E+01	.737E+02
.115E+02	.115E+02	.215E+01	.700E+04	.355E+04	.1157E+03	.212E+01	.779E+02
.116E+02	.116E+02	.216E+01	.747E+04	.373E+04	.1202E+03	.213E+01	.826E+02
.117E+02	.117E+02	.217E+01	.793E+04	.396E+04	.1257E+03	.214E+01	.873E+02
.118E+02	.118E+02	.218E+01	.839E+04	.427E+04	.1317E+03	.215E+01	.920E+02
.119E+02	.119E+02	.219E+01	.885E+04	.442E+04	.1453E+03	.216E+01	.967E+02
.120E+02	.120E+02	.220E+01	.931E+04	.463E+04	.1605E+03	.217E+01	.1015E+02
.121E+02	.121E+02	.221E+01	.976E+04	.483E+04	.1756E+03	.218E+01	.1064E+02
.122E+02	.122E+02	.222E+01	.1023E+04	.503E+04	.1907E+03	.219E+01	.1113E+02
.123E+02	.123E+02	.223E+01	.1070E+04	.523E+04	.2058E+03	.220E+01	.1162E+02
.124E+02	.124E+02	.224E+01	.1117E+04	.543E+04	.2210E+03	.221E+01	.1212E+02
.125E+02	.125E+02	.225E+01	.1164E+04	.563E+04	.2361E+03	.222E+01	.1261E+02
.126E+02	.126E+02	.226E+01	.1211E+04	.583E+04	.2511E+03	.223E+01	.1310E+02
.127E+02	.127E+02	.227E+01	.1258E+04	.603E+04	.2662E+03	.224E+01	.1359E+02
.128E+02	.128E+02	.228E+01	.1305E+04	.623E+04	.2813E+03	.225E+01	.1408E+02
.129E+02	.129E+02	.229E+01	.1352E+04	.643E+04	.2964E+03	.226E+01	.1457E+02
.130E+02	.130E+02	.230E+01	.1400E+04	.663E+04	.3114E+03	.227E+01	.1506E+02
.131E+02	.131E+02	.231E+01	.1447E+04	.683E+04	.3265E+03	.228E+01	.1555E+02
.132E+02	.132E+02	.232E+01	.1494E+04	.703E+04	.3415E+03	.229E+01	.1604E+02
.133E+02	.133E+02	.233E+01	.1541E+04	.723E+04	.3566E+03	.230E+01	.1653E+02
.134E+02	.134E+02	.234E+01	.1588E+04	.743E+04	.3717E+03	.231E+01	.1702E+02
.135E+02	.135E+02	.235E+01	.1635E+04	.763E+04	.3868E+03	.232E+01	.1751E+02
.136E+02	.136E+02	.236E+01	.1682E+04	.783E+04	.4019E+03	.233E+01	.1800E+02
.137E+02	.137E+02	.237E+01	.1729E+04	.803E+04	.4170E+03	.234E+01	.1849E+02
.138E+02	.138E+02	.238E+01	.1776E+04	.823E+04	.4321E+03	.235E+01	.1898E+02
.139E+02	.139E+02	.239E+01	.1823E+04	.843E+04	.4472E+03	.236E+01	.1947E+02
.140E+02	.140E+02	.240E+01	.1870E+04	.863E+04	.4623E+03	.237E+01	.1996E+02
.141E+02	.141E+02	.241E+01	.1917E+04	.883E+04	.4774E+03	.238E+01	.2045E+02
.142E+02	.142E+02	.242E+01	.1964E+04	.903E+04	.4925E+03	.239E+01	.2094E+02
.143E+02	.143E+02	.243E+01	.2011E+04	.923E+04	.5076E+03	.240E+01	.2143E+02
.144E+02	.144E+02	.244E+01	.2058E+04	.943E+04	.5227E+03	.241E+01	.2192E+02
.145E+02	.145E+02	.245E+01	.2105E+04	.963E+04	.5378E+03	.242E+01	.2241E+02
.146E+02	.146E+02	.246E+01	.2152E+04	.983E+04	.5529E+03	.243E+01	.2290E+02
.147E+02	.147E+02	.247E+01	.2199E+04	.1003E+05	.5679E+03	.244E+01	.2339E+02
.148E+02	.148E+02	.248E+01	.2246E+04	.1023E+05	.5830E+03	.245E+01	.2388E+02
.149E+02	.149E+02	.249E+01	.2293E+04	.1043E+05	.5980E+03	.246E+01	.2437E+02
.150E+02	.150E+02	.250E+01	.2340E+04	.1063E+05	.6130E+03	.247E+01	.2486E+02
.151E+02	.151E+02	.251E+01	.2387E+04	.1083E+05	.6280E+03	.248E+01	.2535E+02
.152E+02	.152E+02	.252E+01	.2434E+04	.1103E+05	.6430E+03	.249E+01	.2584E+02
.153E+02	.153E+02	.253E+01	.2481E+04	.1123E+05	.6580E+03	.250E+01	.2633E+02
.154E+02	.154E+02	.254E+01	.2528E+04	.1143E+05	.6730E+03	.251E+01	.2682E+02
.155E+02	.155E+02	.255E+01	.2575E+04	.1163E+05	.6880E+03	.252E+01	.2731E+02
.156E+02	.156E+02	.256E+01	.2622E+04	.1183E+05	.7030E+03	.253E+01	.2780E+02
.157E+02	.157E+02	.257E+01	.2669E+04	.1203E+05	.7180E+03	.254E+01	.2829E+02
.158E+02	.158E+02	.258E+01	.2716E+04	.1223E+05	.7330E+03	.255E+01	.2878E+02
.159E+02	.159E+02	.259E+01	.2763E+04	.1243E+05	.7480E+03	.256E+01	.2927E+02
.160E+02	.160E+02	.260E+01	.2810E+04	.1263E+05	.7630E+03	.257E+01	.2976E+02
.161E+02	.161E+02	.261E+01	.2857E+04	.1283E+05	.7780E+03	.258E+01	.3025E+02
.162E+02	.162E+02	.262E+01	.2904E+04	.1303E+05	.7930E+03	.259E+01	.3074E+02
.163E+02	.163E+02	.263E+01	.2951E+04	.1323E+05	.8080E+03	.260E+01	.3123E+02
.164E+02	.164E+02	.264E+01	.2998E+04	.1343E+05	.8230E+03	.261E+01	.3172E+02
.165E+02	.165E+02	.265E+01	.3045E+04	.1363E+05	.8380E+03	.262E+01	.3221E+02
.166E+02	.166E+02	.266E+01	.3092E+04	.1383E+05	.8530E+03	.263E+01	.3270E+02
.167E+02	.167E+02	.267E+01	.3139E+04	.1403E+05	.8680E+03	.264E+01	.3319E+02
.168E+02	.168E+02	.268E+01	.3186E+04	.1423E+05	.8830E+03	.265E+01	.3368E+02
.169E+02	.169E+02	.269E+01	.3233E+04	.1443E+05	.8980E+03	.266E+01	.3417E+02
.170E+02	.170E+02	.270E+01	.3280E+04	.1463E+05	.9130E+03	.267E+01	.3466E+02
.171E+02	.171E+02	.271E+01	.3327E+04	.1483E+05	.9280E+03	.268E+01	.3515E+02
.172E+02	.172E+02	.272E+01	.3374E+04	.1503E+05	.9430E+03	.269E+01	.3564E+02
.173E+02	.173E+02	.273E+01	.3421E+04	.1523E+05	.9580E+03	.270E+01	.3613E+02
.174E+02	.174E+02	.274E+01	.3468E+04	.1543E+05	.9730E+03	.271E+01	.3662E+02
.175E+02	.175E+02	.275E+01	.3515E+04	.1563E+05	.9880E+03	.272E+01	.3711E+02
.176E+02	.176E+02	.276E+01	.3562E+04	.1583E+05	.10030E+04	.273E+01	.3759E+02
.177E+02	.177E+02	.277E+01	.3609E+04	.1603E+05	.10180E+04	.274E+01	.3808E+02
.178E+02	.178E+02	.278E+01	.3656E+04	.1623E+05	.10330E+04	.275E+01	.3857E+02
.179E+02	.179E+02	.279E+01	.3703E+04	.1643E+05	.10480E+04	.276E+01	.3906E+02
.180E+02	.180E+02	.280E+01	.3750E+04	.1663E+05	.10630E+04	.277E+01	.3955E+02
.181E+02	.181E+02	.281E+01	.3797E+04	.1683E+05	.10780E+04	.278E+01	.4004E+02
.182E+02	.182E+02	.282E+01	.3844E+04	.1703E+05	.10930E+04	.279E+01	.4053E+02
.183E+02	.183E+02	.283E+01	.3891E+04	.1723E+05	.11080E+04	.280E+01	.4102E+02
.184E+02	.184E+02	.284E+01	.3938E+04	.1743E+05	.11230E+04	.281E+01	.4151E+02
.185E+02	.185E+02	.285E+01	.3985E+04	.1763E+05	.11380E+04	.282E+01	.4200E+02
.186E+02	.186E+02	.286E+01	.4032E+04	.1783E+05	.11530E+04	.283E+01	.4249E+02
.187E+02	.187E+02	.287E+01	.4079E+04	.1803E+05	.11680E+04	.284E+01	.4298E+02
.188E+02	.188E+02	.288E+01	.4126E+04	.1823E+05	.11830E+04	.285E+01	.4347E+02
.189E+02	.189E+02	.289E+01	.4173E+04	.1843E+05	.11980E+04	.286E+01	.4396E+02
.190E+02	.190E+02	.290E+01	.4220E+04	.1863E+05	.12130E+04	.287E+01	.4445E+02
.191E+02	.191E+02	.291E+01	.4267E+04	.1883E+05	.12280E+04	.288E+01	.4494E+02
.192E+02	.192E+02	.292E+01	.4314E+04	.1903E+05			

Table 14c

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Table 14d

SOIL
Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

$\frac{dE}{dx} - \text{TOT}$		$\frac{dE}{dx} - \text{PARTIAL}$		$\frac{dE}{dx} - \text{NUCLEAR}$	
E	GeV/C	(GeV/cm^2)	(GeV/cm^2)	(GeV/cm^2)	(GeV/cm^2)
10	1.6	1.6	1.6	1.6	1.6
20	3.2	3.2	3.2	3.2	3.2
30	4.8	4.8	4.8	4.8	4.8
40	6.4	6.4	6.4	6.4	6.4
50	8.0	8.0	8.0	8.0	8.0
60	9.6	9.6	9.6	9.6	9.6
70	11.2	11.2	11.2	11.2	11.2
80	12.8	12.8	12.8	12.8	12.8
90	14.4	14.4	14.4	14.4	14.4
100	16.0	16.0	16.0	16.0	16.0
110	17.6	17.6	17.6	17.6	17.6
120	19.2	19.2	19.2	19.2	19.2
130	20.8	20.8	20.8	20.8	20.8
140	22.4	22.4	22.4	22.4	22.4
150	24.0	24.0	24.0	24.0	24.0
160	25.6	25.6	25.6	25.6	25.6
170	27.2	27.2	27.2	27.2	27.2
180	28.8	28.8	28.8	28.8	28.8
190	30.4	30.4	30.4	30.4	30.4
200	32.0	32.0	32.0	32.0	32.0
210	33.6	33.6	33.6	33.6	33.6
220	35.2	35.2	35.2	35.2	35.2
230	36.8	36.8	36.8	36.8	36.8
240	38.4	38.4	38.4	38.4	38.4
250	40.0	40.0	40.0	40.0	40.0
260	41.6	41.6	41.6	41.6	41.6
270	43.2	43.2	43.2	43.2	43.2
280	44.8	44.8	44.8	44.8	44.8
290	46.4	46.4	46.4	46.4	46.4
300	48.0	48.0	48.0	48.0	48.0
310	49.6	49.6	49.6	49.6	49.6
320	51.2	51.2	51.2	51.2	51.2
330	52.8	52.8	52.8	52.8	52.8
340	54.4	54.4	54.4	54.4	54.4
350	56.0	56.0	56.0	56.0	56.0
360	57.6	57.6	57.6	57.6	57.6
370	59.2	59.2	59.2	59.2	59.2
380	60.8	60.8	60.8	60.8	60.8
390	62.4	62.4	62.4	62.4	62.4
400	64.0	64.0	64.0	64.0	64.0
410	65.6	65.6	65.6	65.6	65.6
420	67.2	67.2	67.2	67.2	67.2
430	68.8	68.8	68.8	68.8	68.8
440	70.4	70.4	70.4	70.4	70.4
450	72.0	72.0	72.0	72.0	72.0
460	73.6	73.6	73.6	73.6	73.6
470	75.2	75.2	75.2	75.2	75.2
480	76.8	76.8	76.8	76.8	76.8
490	78.4	78.4	78.4	78.4	78.4
500	80.0	80.0	80.0	80.0	80.0
510	81.6	81.6	81.6	81.6	81.6
520	83.2	83.2	83.2	83.2	83.2
530	84.8	84.8	84.8	84.8	84.8
540	86.4	86.4	86.4	86.4	86.4
550	88.0	88.0	88.0	88.0	88.0
560	89.6	89.6	89.6	89.6	89.6
570	91.2	91.2	91.2	91.2	91.2
580	92.8	92.8	92.8	92.8	92.8
590	94.4	94.4	94.4	94.4	94.4
600	96.0	96.0	96.0	96.0	96.0
610	97.6	97.6	97.6	97.6	97.6
620	99.2	99.2	99.2	99.2	99.2
630	100.8	100.8	100.8	100.8	100.8
640	102.4	102.4	102.4	102.4	102.4
650	104.0	104.0	104.0	104.0	104.0
660	105.6	105.6	105.6	105.6	105.6
670	107.2	107.2	107.2	107.2	107.2
680	108.8	108.8	108.8	108.8	108.8
690	110.4	110.4	110.4	110.4	110.4
700	112.0	112.0	112.0	112.0	112.0
710	113.6	113.6	113.6	113.6	113.6
720	115.2	115.2	115.2	115.2	115.2
730	116.8	116.8	116.8	116.8	116.8
740	118.4	118.4	118.4	118.4	118.4
750	120.0	120.0	120.0	120.0	120.0
760	121.6	121.6	121.6	121.6	121.6
770	123.2	123.2	123.2	123.2	123.2
780	124.8	124.8	124.8	124.8	124.8
790	126.4	126.4	126.4	126.4	126.4
800	128.0	128.0	128.0	128.0	128.0
810	129.6	129.6	129.6	129.6	129.6
820	131.2	131.2	131.2	131.2	131.2
830	132.8	132.8	132.8	132.8	132.8
840	134.4	134.4	134.4	134.4	134.4
850	136.0	136.0	136.0	136.0	136.0
860	137.6	137.6	137.6	137.6	137.6
870	139.2	139.2	139.2	139.2	139.2
880	140.8	140.8	140.8	140.8	140.8
890	142.4	142.4	142.4	142.4	142.4
900	144.0	144.0	144.0	144.0	144.0
910	145.6	145.6	145.6	145.6	145.6
920	147.2	147.2	147.2	147.2	147.2
930	148.8	148.8	148.8	148.8	148.8
940	150.4	150.4	150.4	150.4	150.4
950	152.0	152.0	152.0	152.0	152.0
960	153.6	153.6	153.6	153.6	153.6
970	155.2	155.2	155.2	155.2	155.2
980	156.8	156.8	156.8	156.8	156.8
990	158.4	158.4	158.4	158.4	158.4
1000	160.0	160.0	160.0	160.0	160.0

Table 15a

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Table 15b

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Detailed description: This figure is a scatter plot showing the ratio of differential cross sections for pion production in deuterium-oxo-partially-strained nuclear collisions to total pion production (DE/ΔΩ-TOT) on the y-axis against the range (RANGE) on the x-axis. The y-axis has a logarithmic scale with major ticks at 0.1, 1.0, and 10. The x-axis has a logarithmic scale with major ticks at 0.1, 1, and 10. Data points are represented by '+' symbols. There are several series of data points corresponding to different beam momenta (p) and center-of-mass energies (s). The data points generally show a decreasing trend as the range increases, with some local fluctuations.

RANGE	DE/ΔΩ-TOT (p=1 GeV/c)	DE/ΔΩ-TOT (p=2 GeV/c)	DE/ΔΩ-TOT (p=3 GeV/c)	DE/ΔΩ-TOT (p=4 GeV/c)	DE/ΔΩ-TOT (p=5 GeV/c)	DE/ΔΩ-TOT (p=6 GeV/c)	DE/ΔΩ-TOT (p=7 GeV/c)	DE/ΔΩ-TOT (p=8 GeV/c)	DE/ΔΩ-TOT (p=9 GeV/c)	DE/ΔΩ-TOT (p=10 GeV/c)
0.1	0.15	0.18	0.20	0.22	0.25	0.28	0.30	0.32	0.35	0.38
1	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30
10	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26

Table 15c

LEAD

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

P	$dE/dx - \text{TOT}$ (GeV/CU/CHSQ)	$dE/dx - \text{PAIR}$ (GeV/CU/CHSQ)	$dE/dx - \text{PARTIAL}$ (GeV/CU/CHSQ)	NUCLEAR	
				COLLISION (ALL)	COLLISION (PAIR)
100	1.30E+01	1.30E+01	1.30E+01	1.30E+01	1.30E+01
200	1.81E+01	1.81E+01	1.81E+01	1.81E+01	1.81E+01
300	2.32E+01	2.32E+01	2.32E+01	2.32E+01	2.32E+01
400	2.83E+01	2.83E+01	2.83E+01	2.83E+01	2.83E+01
500	3.34E+01	3.34E+01	3.34E+01	3.34E+01	3.34E+01
600	3.85E+01	3.85E+01	3.85E+01	3.85E+01	3.85E+01
700	4.36E+01	4.36E+01	4.36E+01	4.36E+01	4.36E+01
800	4.87E+01	4.87E+01	4.87E+01	4.87E+01	4.87E+01
900	5.38E+01	5.38E+01	5.38E+01	5.38E+01	5.38E+01
1000	5.89E+01	5.89E+01	5.89E+01	5.89E+01	5.89E+01
1200	6.40E+01	6.40E+01	6.40E+01	6.40E+01	6.40E+01
1400	6.91E+01	6.91E+01	6.91E+01	6.91E+01	6.91E+01
1600	7.42E+01	7.42E+01	7.42E+01	7.42E+01	7.42E+01
1800	7.93E+01	7.93E+01	7.93E+01	7.93E+01	7.93E+01
2000	8.44E+01	8.44E+01	8.44E+01	8.44E+01	8.44E+01
2200	8.95E+01	8.95E+01	8.95E+01	8.95E+01	8.95E+01
2400	9.46E+01	9.46E+01	9.46E+01	9.46E+01	9.46E+01
2600	9.97E+01	9.97E+01	9.97E+01	9.97E+01	9.97E+01
2800	1.048E+02	1.048E+02	1.048E+02	1.048E+02	1.048E+02
3000	1.099E+02	1.099E+02	1.099E+02	1.099E+02	1.099E+02
3200	1.150E+02	1.150E+02	1.150E+02	1.150E+02	1.150E+02
3400	1.199E+02	1.199E+02	1.199E+02	1.199E+02	1.199E+02
3600	1.240E+02	1.240E+02	1.240E+02	1.240E+02	1.240E+02
3800	1.281E+02	1.281E+02	1.281E+02	1.281E+02	1.281E+02
4000	1.322E+02	1.322E+02	1.322E+02	1.322E+02	1.322E+02
4200	1.363E+02	1.363E+02	1.363E+02	1.363E+02	1.363E+02
4400	1.404E+02	1.404E+02	1.404E+02	1.404E+02	1.404E+02
4600	1.445E+02	1.445E+02	1.445E+02	1.445E+02	1.445E+02
4800	1.486E+02	1.486E+02	1.486E+02	1.486E+02	1.486E+02
5000	1.527E+02	1.527E+02	1.527E+02	1.527E+02	1.527E+02
5200	1.568E+02	1.568E+02	1.568E+02	1.568E+02	1.568E+02
5400	1.609E+02	1.609E+02	1.609E+02	1.609E+02	1.609E+02
5600	1.650E+02	1.650E+02	1.650E+02	1.650E+02	1.650E+02
5800	1.691E+02	1.691E+02	1.691E+02	1.691E+02	1.691E+02
6000	1.732E+02	1.732E+02	1.732E+02	1.732E+02	1.732E+02
6200	1.773E+02	1.773E+02	1.773E+02	1.773E+02	1.773E+02
6400	1.814E+02	1.814E+02	1.814E+02	1.814E+02	1.814E+02
6600	1.855E+02	1.855E+02	1.855E+02	1.855E+02	1.855E+02
6800	1.896E+02	1.896E+02	1.896E+02	1.896E+02	1.896E+02
7000	1.937E+02	1.937E+02	1.937E+02	1.937E+02	1.937E+02
7200	1.978E+02	1.978E+02	1.978E+02	1.978E+02	1.978E+02
7400	2.019E+02	2.019E+02	2.019E+02	2.019E+02	2.019E+02
7600	2.060E+02	2.060E+02	2.060E+02	2.060E+02	2.060E+02
7800	2.101E+02	2.101E+02	2.101E+02	2.101E+02	2.101E+02
8000	2.142E+02	2.142E+02	2.142E+02	2.142E+02	2.142E+02
8200	2.183E+02	2.183E+02	2.183E+02	2.183E+02	2.183E+02
8400	2.224E+02	2.224E+02	2.224E+02	2.224E+02	2.224E+02
8600	2.265E+02	2.265E+02	2.265E+02	2.265E+02	2.265E+02
8800	2.306E+02	2.306E+02	2.306E+02	2.306E+02	2.306E+02
9000	2.347E+02	2.347E+02	2.347E+02	2.347E+02	2.347E+02
9200	2.388E+02	2.388E+02	2.388E+02	2.388E+02	2.388E+02
9400	2.429E+02	2.429E+02	2.429E+02	2.429E+02	2.429E+02
9600	2.470E+02	2.470E+02	2.470E+02	2.470E+02	2.470E+02
9800	2.511E+02	2.511E+02	2.511E+02	2.511E+02	2.511E+02
10000	2.552E+02	2.552E+02	2.552E+02	2.552E+02	2.552E+02
10200	2.593E+02	2.593E+02	2.593E+02	2.593E+02	2.593E+02
10400	2.634E+02	2.634E+02	2.634E+02	2.634E+02	2.634E+02
10600	2.675E+02	2.675E+02	2.675E+02	2.675E+02	2.675E+02
10800	2.716E+02	2.716E+02	2.716E+02	2.716E+02	2.716E+02
11000	2.757E+02	2.757E+02	2.757E+02	2.757E+02	2.757E+02
11200	2.798E+02	2.798E+02	2.798E+02	2.798E+02	2.798E+02
11400	2.839E+02	2.839E+02	2.839E+02	2.839E+02	2.839E+02
11600	2.880E+02	2.880E+02	2.880E+02	2.880E+02	2.880E+02
11800	2.921E+02	2.921E+02	2.921E+02	2.921E+02	2.921E+02
12000	2.962E+02	2.962E+02	2.962E+02	2.962E+02	2.962E+02
12200	3.003E+02	3.003E+02	3.003E+02	3.003E+02	3.003E+02
12400	3.044E+02	3.044E+02	3.044E+02	3.044E+02	3.044E+02
12600	3.085E+02	3.085E+02	3.085E+02	3.085E+02	3.085E+02
12800	3.126E+02	3.126E+02	3.126E+02	3.126E+02	3.126E+02
13000	3.167E+02	3.167E+02	3.167E+02	3.167E+02	3.167E+02
13200	3.208E+02	3.208E+02	3.208E+02	3.208E+02	3.208E+02
13400	3.249E+02	3.249E+02	3.249E+02	3.249E+02	3.249E+02
13600	3.290E+02	3.290E+02	3.290E+02	3.290E+02	3.290E+02
13800	3.331E+02	3.331E+02	3.331E+02	3.331E+02	3.331E+02
14000	3.372E+02	3.372E+02	3.372E+02	3.372E+02	3.372E+02
14200	3.413E+02	3.413E+02	3.413E+02	3.413E+02	3.413E+02
14400	3.454E+02	3.454E+02	3.454E+02	3.454E+02	3.454E+02
14600	3.495E+02	3.495E+02	3.495E+02	3.495E+02	3.495E+02
14800	3.536E+02	3.536E+02	3.536E+02	3.536E+02	3.536E+02
15000	3.577E+02	3.577E+02	3.577E+02	3.577E+02	3.577E+02
15200	3.618E+02	3.618E+02	3.618E+02	3.618E+02	3.618E+02
15400	3.659E+02	3.659E+02	3.659E+02	3.659E+02	3.659E+02
15600	3.700E+02	3.700E+02	3.700E+02	3.700E+02	3.700E+02
15800	3.741E+02	3.741E+02	3.741E+02	3.741E+02	3.741E+02
16000	3.782E+02	3.782E+02	3.782E+02	3.782E+02	3.782E+02
16200	3.823E+02	3.823E+02	3.823E+02	3.823E+02	3.823E+02
16400	3.864E+02	3.864E+02	3.864E+02	3.864E+02	3.864E+02
16600	3.905E+02	3.905E+02	3.905E+02	3.905E+02	3.905E+02
16800	3.946E+02	3.946E+02	3.946E+02	3.946E+02	3.946E+02
17000	3.987E+02	3.987E+02	3.987E+02	3.987E+02	3.987E+02
17200	4.028E+02	4.028E+02	4.028E+02	4.028E+02	4.028E+02
17400	4.069E+02	4.069E+02	4.069E+02	4.069E+02	4.069E+02
17600	4.110E+02	4.110E+02	4.110E+02	4.110E+02	4.110E+02
17800	4.151E+02	4.151E+02	4.151E+02	4.151E+02	4.151E+02
18000	4.192E+02	4.192E+02	4.192E+02	4.192E+02	4.192E+02
18200	4.233E+02	4.233E+02	4.233E+02	4.233E+02	4.233E+02
18400	4.274E+02	4.274E+02	4.274E+02	4.274E+02	4.274E+02
18600	4.315E+02	4.315E+02	4.315E+02	4.315E+02	4.315E+02
18800	4.356E+02	4.356E+02	4.356E+02	4.356E+02	4.356E+02
19000	4.397E+02	4.397E+02	4.397E+02	4.397E+02	4.397E+02
19200	4.438E+02	4.438E+02	4.438E+02	4.438E+02	4.438E+02
19400	4.479E+02	4.479E+02	4.479E+02	4.479E+02	4.479E+02
19600	4.520E+02	4.520E+02	4.520E+02	4.520E+02	4.520E+02
19800	4.561E+02	4.561E+02	4.561E+02	4.561E+02	4.561E+02
20000	4.602E+02	4.602E+02	4.602E+02	4.602E+02	4.602E+02
20200	4.643E+02	4.643E+02	4.643E+02	4.643E+02	4.643E+02
20400	4.684E+02	4.684E+02	4.684E+02	4.684E+02	4.684E+02
20600	4.725E+02	4.725E+02	4.725E+02	4.725E+02	4.725E+02
20800	4.766E+02	4.766E+02	4.766E+02	4.766E+02	4.766E+02
21000	4.807E+02	4.807E+02	4.807E+02	4.807E+02	4.807E+02
21200	4.848E+02	4.848E+02	4.848E+02	4.848E+02	4.848E+02
21400	4.889E+02	4.889E+02	4.889E+02	4.889E+02	4.889E+02
21600	4.930E+02	4.930E+02	4.930E+02	4.930E+02	4.930E+02
21800	4.971E+02	4.971E+02	4.971E+02	4.971E+02	4.971E+02
22000	5.012E+02	5.012E+02	5.012E+02	5.012E+02	5.012E+02
22200	5.053E+02	5.053E+02	5.053E+02	5.053E+02	5.053E+02
22400	5.094E+02	5.094E+02	5.094E+02	5.094E+02	5.094E+02
22600	5.135E+02	5.135E+02	5.135E+02	5.135E+02	5.135E+02
22800	5.176E+02	5.176E+02	5.176E+02	5.176E+02	5.176E+02
23000	5.217E+02	5.217E+02	5.217E+02	5.217E+02	5.217E+02
23200	5.258E+02	5.258E+02	5.258E+02	5.258E+02	5.258E+02
23400	5.300E+02	5.300E+02	5.300E+02	5.300E+02	5.300E+02
23600	5.341E+02	5.341E+02	5.341E+02	5.341E+02	5.341E+02
23800	5.382E+02	5.382E+02	5.382E+02	5.382E+02	5.382E+02
24000	5.423E+02	5.423E+02	5.423E+02	5.423E+02	5.423E+02
24200	5.464E+02	5.464E+02	5.464E+02	5.464E+02	5.464E+02
24400	5.505E+02	5.505E+02	5.505E+02	5.505E+0	

Table 15d

LEAD

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

E (GeV/C)	DE/DX-TOT		PAIR (ALL IN 1930)		PAIR (1930)		NUCLEAR	
	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)	(GeV/C)
500	0.3	1.15	0.3	0.15	0.05	0.05	0.05	0.05
600	0.3	1.18	0.3	0.18	0.06	0.06	0.06	0.06
700	0.3	1.22	0.3	0.22	0.07	0.07	0.07	0.07
800	0.3	1.26	0.3	0.26	0.08	0.08	0.08	0.08
900	0.3	1.30	0.3	0.30	0.09	0.09	0.09	0.09
1000	0.3	1.34	0.3	0.34	0.10	0.10	0.10	0.10
1100	0.3	1.38	0.3	0.38	0.11	0.11	0.11	0.11
1200	0.3	1.42	0.3	0.42	0.12	0.12	0.12	0.12
1300	0.3	1.46	0.3	0.46	0.13	0.13	0.13	0.13
1400	0.3	1.50	0.3	0.50	0.14	0.14	0.14	0.14
1500	0.3	1.54	0.3	0.54	0.15	0.15	0.15	0.15
1600	0.3	1.58	0.3	0.58	0.16	0.16	0.16	0.16
1700	0.3	1.62	0.3	0.62	0.17	0.17	0.17	0.17
1800	0.3	1.66	0.3	0.66	0.18	0.18	0.18	0.18
1900	0.3	1.70	0.3	0.70	0.19	0.19	0.19	0.19
2000	0.3	1.74	0.3	0.74	0.20	0.20	0.20	0.20
2100	0.3	1.78	0.3	0.78	0.21	0.21	0.21	0.21
2200	0.3	1.82	0.3	0.82	0.22	0.22	0.22	0.22
2300	0.3	1.86	0.3	0.86	0.23	0.23	0.23	0.23
2400	0.3	1.90	0.3	0.90	0.24	0.24	0.24	0.24
2500	0.3	1.94	0.3	0.94	0.25	0.25	0.25	0.25
2600	0.3	1.98	0.3	0.98	0.26	0.26	0.26	0.26
2700	0.3	2.02	0.3	1.02	0.27	0.27	0.27	0.27
2800	0.3	2.06	0.3	1.06	0.28	0.28	0.28	0.28
2900	0.3	2.10	0.3	1.10	0.29	0.29	0.29	0.29
3000	0.3	2.14	0.3	1.14	0.30	0.30	0.30	0.30
3100	0.3	2.18	0.3	1.18	0.31	0.31	0.31	0.31
3200	0.3	2.22	0.3	1.22	0.32	0.32	0.32	0.32
3300	0.3	2.26	0.3	1.26	0.33	0.33	0.33	0.33
3400	0.3	2.30	0.3	1.30	0.34	0.34	0.34	0.34
3500	0.3	2.34	0.3	1.34	0.35	0.35	0.35	0.35
3600	0.3	2.38	0.3	1.38	0.36	0.36	0.36	0.36
3700	0.3	2.42	0.3	1.42	0.37	0.37	0.37	0.37
3800	0.3	2.46	0.3	1.46	0.38	0.38	0.38	0.38
3900	0.3	2.50	0.3	1.50	0.39	0.39	0.39	0.39
4000	0.3	2.54	0.3	1.54	0.40	0.40	0.40	0.40
4100	0.3	2.58	0.3	1.58	0.41	0.41	0.41	0.41
4200	0.3	2.62	0.3	1.62	0.42	0.42	0.42	0.42
4300	0.3	2.66	0.3	1.66	0.43	0.43	0.43	0.43
4400	0.3	2.70	0.3	1.70	0.44	0.44	0.44	0.44
4500	0.3	2.74	0.3	1.74	0.45	0.45	0.45	0.45
4600	0.3	2.78	0.3	1.78	0.46	0.46	0.46	0.46
4700	0.3	2.82	0.3	1.82	0.47	0.47	0.47	0.47
4800	0.3	2.86	0.3	1.86	0.48	0.48	0.48	0.48
4900	0.3	2.90	0.3	1.90	0.49	0.49	0.49	0.49
5000	0.3	2.94	0.3	1.94	0.50	0.50	0.50	0.50
5100	0.3	2.98	0.3	1.98	0.51	0.51	0.51	0.51
5200	0.3	3.02	0.3	2.02	0.52	0.52	0.52	0.52
5300	0.3	3.06	0.3	2.06	0.53	0.53	0.53	0.53
5400	0.3	3.10	0.3	2.10	0.54	0.54	0.54	0.54
5500	0.3	3.14	0.3	2.14	0.55	0.55	0.55	0.55
5600	0.3	3.18	0.3	2.18	0.56	0.56	0.56	0.56
5700	0.3	3.22	0.3	2.22	0.57	0.57	0.57	0.57
5800	0.3	3.26	0.3	2.26	0.58	0.58	0.58	0.58
5900	0.3	3.30	0.3	2.30	0.59	0.59	0.59	0.59
6000	0.3	3.34	0.3	2.34	0.60	0.60	0.60	0.60
6100	0.3	3.38	0.3	2.38	0.61	0.61	0.61	0.61
6200	0.3	3.42	0.3	2.42	0.62	0.62	0.62	0.62
6300	0.3	3.46	0.3	2.46	0.63	0.63	0.63	0.63
6400	0.3	3.50	0.3	2.50	0.64	0.64	0.64	0.64
6500	0.3	3.54	0.3	2.54	0.65	0.65	0.65	0.65
6600	0.3	3.58	0.3	2.58	0.66	0.66	0.66	0.66
6700	0.3	3.62	0.3	2.62	0.67	0.67	0.67	0.67
6800	0.3	3.66	0.3	2.66	0.68	0.68	0.68	0.68
6900	0.3	3.70	0.3	2.70	0.69	0.69	0.69	0.69
7000	0.3	3.74	0.3	2.74	0.70	0.70	0.70	0.70
7100	0.3	3.78	0.3	2.78	0.71	0.71	0.71	0.71
7200	0.3	3.82	0.3	2.82	0.72	0.72	0.72	0.72
7300	0.3	3.86	0.3	2.86	0.73	0.73	0.73	0.73
7400	0.3	3.90	0.3	2.90	0.74	0.74	0.74	0.74
7500	0.3	3.94	0.3	2.94	0.75	0.75	0.75	0.75
7600	0.3	3.98	0.3	2.98	0.76	0.76	0.76	0.76
7700	0.3	4.02	0.3	3.02	0.77	0.77	0.77	0.77
7800	0.3	4.06	0.3	3.06	0.78	0.78	0.78	0.78
7900	0.3	4.10	0.3	3.10	0.79	0.79	0.79	0.79
8000	0.3	4.14	0.3	3.14	0.80	0.80	0.80	0.80
8100	0.3	4.18	0.3	3.18	0.81	0.81	0.81	0.81
8200	0.3	4.22	0.3	3.22	0.82	0.82	0.82	0.82
8300	0.3	4.26	0.3	3.26	0.83	0.83	0.83	0.83
8400	0.3	4.30	0.3	3.30	0.84	0.84	0.84	0.84
8500	0.3	4.34	0.3	3.34	0.85	0.85	0.85	0.85
8600	0.3	4.38	0.3	3.38	0.86	0.86	0.86	0.86
8700	0.3	4.42	0.3	3.42	0.87	0.87	0.87	0.87
8800	0.3	4.46	0.3	3.46	0.88	0.88	0.88	0.88
8900	0.3	4.50	0.3	3.50	0.89	0.89	0.89	0.89
9000	0.3	4.54	0.3	3.54	0.90	0.90	0.90	0.90
9100	0.3	4.58	0.3	3.58	0.91	0.91	0.91	0.91
9200	0.3	4.62	0.3	3.62	0.92	0.92	0.92	0.92
9300	0.3	4.66	0.3	3.66	0.93	0.93	0.93	0.93
9400	0.3	4.70	0.3	3.70	0.94	0.94	0.94	0.94
9500	0.3	4.74	0.3	3.74	0.95	0.95	0.95	0.95
9600	0.3	4.78	0.3	3.78	0.96	0.96	0.96	0.96
9700	0.3	4.82	0.3	3.82	0.97	0.97	0.97	0.97
9800	0.3	4.86	0.3	3.86	0.98	0.98	0.98	0.98
9900	0.3	4.90	0.3	3.90	0.99	0.99	0.99	0.99
10000	0.3	4.94	0.3	3.94	1.00	1.00	1.00	1.00

Table 16b

URANIUM
Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

DE/DX-TOT		RANGE	COLLISION (ALL IN NUCLEAR)	PAIR PROD. (N/M/MSI)	DE/DX-PARTIAL
(GeV/C/N ₂ O)	(GeV/C ₂ H ₆)	(CN)	(CN)	(N/M/MSI)	
1.91E+04	1.37E+04	1.00E+03	1.36E+01	6.92E-02	1.75E-02
2.06E+04	1.42E+04	1.13E+03	1.37E+01	6.92E-02	1.90E-02
2.20E+04	1.47E+04	1.30E+03	1.39E+01	6.76E-02	1.90E-02
2.35E+04	1.52E+04	1.42E+03	1.40E+01	6.75E-02	1.90E-02
2.50E+04	1.57E+04	1.50E+03	1.41E+01	6.75E-02	1.90E-02
2.65E+04	1.62E+04	1.58E+03	1.42E+01	6.75E-02	1.90E-02
2.80E+04	1.67E+04	1.66E+03	1.43E+01	6.75E-02	1.90E-02
2.95E+04	1.72E+04	1.74E+03	1.44E+01	6.75E-02	1.90E-02
3.10E+04	1.77E+04	1.82E+03	1.45E+01	6.75E-02	1.90E-02
3.25E+04	1.82E+04	1.90E+03	1.46E+01	6.75E-02	1.90E-02
3.40E+04	1.87E+04	1.98E+03	1.47E+01	6.75E-02	1.90E-02
3.55E+04	1.92E+04	2.06E+03	1.48E+01	6.75E-02	1.90E-02
3.70E+04	1.97E+04	2.14E+03	1.49E+01	6.75E-02	1.90E-02
3.85E+04	2.02E+04	2.22E+03	1.50E+01	6.75E-02	1.90E-02
4.00E+04	2.07E+04	2.30E+03	1.51E+01	6.75E-02	1.90E-02
4.15E+04	2.12E+04	2.38E+03	1.52E+01	6.75E-02	1.90E-02
4.30E+04	2.17E+04	2.46E+03	1.53E+01	6.75E-02	1.90E-02
4.45E+04	2.22E+04	2.54E+03	1.54E+01	6.75E-02	1.90E-02
4.60E+04	2.27E+04	2.62E+03	1.55E+01	6.75E-02	1.90E-02
4.75E+04	2.32E+04	2.70E+03	1.56E+01	6.75E-02	1.90E-02
4.90E+04	2.37E+04	2.78E+03	1.57E+01	6.75E-02	1.90E-02
5.05E+04	2.42E+04	2.86E+03	1.58E+01	6.75E-02	1.90E-02
5.20E+04	2.47E+04	2.94E+03	1.59E+01	6.75E-02	1.90E-02
5.35E+04	2.52E+04	3.02E+03	1.60E+01	6.75E-02	1.90E-02
5.50E+04	2.57E+04	3.10E+03	1.61E+01	6.75E-02	1.90E-02
5.65E+04	2.62E+04	3.18E+03	1.62E+01	6.75E-02	1.90E-02
5.80E+04	2.67E+04	3.26E+03	1.63E+01	6.75E-02	1.90E-02
5.95E+04	2.72E+04	3.34E+03	1.64E+01	6.75E-02	1.90E-02
6.10E+04	2.77E+04	3.42E+03	1.65E+01	6.75E-02	1.90E-02
6.25E+04	2.82E+04	3.50E+03	1.66E+01	6.75E-02	1.90E-02
6.40E+04	2.87E+04	3.58E+03	1.67E+01	6.75E-02	1.90E-02
6.55E+04	2.92E+04	3.66E+03	1.68E+01	6.75E-02	1.90E-02
6.70E+04	2.97E+04	3.74E+03	1.69E+01	6.75E-02	1.90E-02
6.85E+04	3.02E+04	3.82E+03	1.70E+01	6.75E-02	1.90E-02
7.00E+04	3.07E+04	3.90E+03	1.71E+01	6.75E-02	1.90E-02
7.15E+04	3.12E+04	3.98E+03	1.72E+01	6.75E-02	1.90E-02
7.30E+04	3.17E+04	4.06E+03	1.73E+01	6.75E-02	1.90E-02
7.45E+04	3.22E+04	4.14E+03	1.74E+01	6.75E-02	1.90E-02
7.60E+04	3.27E+04	4.22E+03	1.75E+01	6.75E-02	1.90E-02
7.75E+04	3.32E+04	4.30E+03	1.76E+01	6.75E-02	1.90E-02
7.90E+04	3.37E+04	4.38E+03	1.77E+01	6.75E-02	1.90E-02
8.05E+04	3.42E+04	4.46E+03	1.78E+01	6.75E-02	1.90E-02
8.20E+04	3.47E+04	4.54E+03	1.79E+01	6.75E-02	1.90E-02
8.35E+04	3.52E+04	4.62E+03	1.80E+01	6.75E-02	1.90E-02
8.50E+04	3.57E+04	4.70E+03	1.81E+01	6.75E-02	1.90E-02
8.65E+04	3.62E+04	4.78E+03	1.82E+01	6.75E-02	1.90E-02
8.80E+04	3.67E+04	4.86E+03	1.83E+01	6.75E-02	1.90E-02
8.95E+04	3.72E+04	4.94E+03	1.84E+01	6.75E-02	1.90E-02
9.10E+04	3.77E+04	5.02E+03	1.85E+01	6.75E-02	1.90E-02
9.25E+04	3.82E+04	5.10E+03	1.86E+01	6.75E-02	1.90E-02
9.40E+04	3.87E+04	5.18E+03	1.87E+01	6.75E-02	1.90E-02
9.55E+04	3.92E+04	5.26E+03	1.88E+01	6.75E-02	1.90E-02
9.70E+04	3.97E+04	5.34E+03	1.89E+01	6.75E-02	1.90E-02
9.85E+04	4.02E+04	5.42E+03	1.90E+01	6.75E-02	1.90E-02
1.00E+05	4.07E+04	5.50E+03	1.91E+01	6.75E-02	1.90E-02
1.01E+05	4.12E+04	5.58E+03	1.92E+01	6.75E-02	1.90E-02
1.02E+05	4.17E+04	5.66E+03	1.93E+01	6.75E-02	1.90E-02
1.03E+05	4.22E+04	5.74E+03	1.94E+01	6.75E-02	1.90E-02
1.04E+05	4.27E+04	5.82E+03	1.95E+01	6.75E-02	1.90E-02
1.05E+05	4.32E+04	5.90E+03	1.96E+01	6.75E-02	1.90E-02
1.06E+05	4.37E+04	5.98E+03	1.97E+01	6.75E-02	1.90E-02
1.07E+05	4.42E+04	6.06E+03	1.98E+01	6.75E-02	1.90E-02
1.08E+05	4.47E+04	6.14E+03	1.99E+01	6.75E-02	1.90E-02
1.09E+05	4.52E+04	6.22E+03	2.00E+01	6.75E-02	1.90E-02
1.10E+05	4.57E+04	6.30E+03	2.01E+01	6.75E-02	1.90E-02
1.11E+05	4.62E+04	6.38E+03	2.02E+01	6.75E-02	1.90E-02
1.12E+05	4.67E+04	6.46E+03	2.03E+01	6.75E-02	1.90E-02
1.13E+05	4.72E+04	6.54E+03	2.04E+01	6.75E-02	1.90E-02
1.14E+05	4.77E+04	6.62E+03	2.05E+01	6.75E-02	1.90E-02
1.15E+05	4.82E+04	6.70E+03	2.06E+01	6.75E-02	1.90E-02
1.16E+05	4.87E+04	6.78E+03	2.07E+01	6.75E-02	1.90E-02
1.17E+05	4.92E+04	6.86E+03	2.08E+01	6.75E-02	1.90E-02
1.18E+05	4.97E+04	6.94E+03	2.09E+01	6.75E-02	1.90E-02
1.19E+05	5.02E+04	7.02E+03	2.10E+01	6.75E-02	1.90E-02
1.20E+05	5.07E+04	7.10E+03	2.11E+01	6.75E-02	1.90E-02
1.21E+05	5.12E+04	7.18E+03	2.12E+01	6.75E-02	1.90E-02
1.22E+05	5.17E+04	7.26E+03	2.13E+01	6.75E-02	1.90E-02
1.23E+05	5.22E+04	7.34E+03	2.14E+01	6.75E-02	1.90E-02
1.24E+05	5.27E+04	7.42E+03	2.15E+01	6.75E-02	1.90E-02
1.25E+05	5.32E+04	7.50E+03	2.16E+01	6.75E-02	1.90E-02
1.26E+05	5.37E+04	7.58E+03	2.17E+01	6.75E-02	1.90E-02
1.27E+05	5.42E+04	7.66E+03	2.18E+01	6.75E-02	1.90E-02
1.28E+05	5.47E+04	7.74E+03	2.19E+01	6.75E-02	1.90E-02
1.29E+05	5.52E+04	7.82E+03	2.20E+01	6.75E-02	1.90E-02
1.30E+05	5.57E+04	7.90E+03	2.21E+01	6.75E-02	1.90E-02
1.31E+05	5.62E+04	7.98E+03	2.22E+01	6.75E-02	1.90E-02
1.32E+05	5.67E+04	8.06E+03	2.23E+01	6.75E-02	1.90E-02
1.33E+05	5.72E+04	8.14E+03	2.24E+01	6.75E-02	1.90E-02
1.34E+05	5.77E+04	8.22E+03	2.25E+01	6.75E-02	1.90E-02
1.35E+05	5.82E+04	8.30E+03	2.26E+01	6.75E-02	1.90E-02
1.36E+05	5.87E+04	8.38E+03	2.27E+01	6.75E-02	1.90E-02
1.37E+05	5.92E+04	8.46E+03	2.28E+01	6.75E-02	1.90E-02
1.38E+05	5.97E+04	8.54E+03	2.29E+01	6.75E-02	1.90E-02
1.39E+05	6.02E+04	8.62E+03	2.30E+01	6.75E-02	1.90E-02
1.40E+05	6.07E+04	8.70E+03	2.31E+01	6.75E-02	1.90E-02
1.41E+05	6.12E+04	8.78E+03	2.32E+01	6.75E-02	1.90E-02
1.42E+05	6.17E+04	8.86E+03	2.33E+01	6.75E-02	1.90E-02
1.43E+05	6.22E+04	8.94E+03	2.34E+01	6.75E-02	1.90E-02
1.44E+05	6.27E+04	9.02E+03	2.35E+01	6.75E-02	1.90E-02
1.45E+05	6.32E+04	9.10E+03	2.36E+01	6.75E-02	1.90E-02
1.46E+05	6.37E+04	9.18E+03	2.37E+01	6.75E-02	1.90E-02
1.47E+05	6.42E+04	9.26E+03	2.38E+01	6.75E-02	1.90E-02
1.48E+05	6.47E+04	9.34E+03	2.39E+01	6.75E-02	1.90E-02
1.49E+05	6.52E+04	9.42E+03	2.40E+01	6.75E-02	1.90E-02
1.50E+05	6.57E+04	9.50E+03	2.41E+01	6.75E-02	1.90E-02
1.51E+05	6.62E+04	9.58E+03	2.42E+01	6.75E-02	1.90E-02
1.52E+05	6.67E+04	9.66E+03	2.43E+01	6.75E-02	1.90E-02
1.53E+05	6.72E+04	9.74E+03	2.44E+01	6.75E-02	1.90E-02
1.54E+05	6.77E+04	9.82E+03	2.45E+01	6.75E-02	1.90E-02
1.55E+05	6.82E+04	9.90E+03	2.46E+01	6.75E-02	1.90E-02
1.56E+05	6.87E+04	9.98E+03	2.47E+01	6.75E-02	1.90E-02
1.57E+05	6.92E+04	1.006E+04	2.48E+01	6.75E-02	1.90E-02
1.58E+05	6.97E+04	1.014E+04	2.49E+01	6.75E-02	1.90E-02
1.59E+05	7.02E+04	1.022E+04	2.50E+01	6.75E-02	1.90E-02
1.60E+05	7.07E+04	1.030E+04	2.51E+01	6.75E-02	1.90E-02
1.61E+05	7.12E+04	1.038E+04	2.52E+01	6.75E-02	1.90E-02
1.62E+05	7.17E+04	1.046E+04	2.53E+01	6.75E-02	1.90E-02
1.63E+05	7.22E+04	1.054E+04	2.54E+01	6.75E-02	1.90E-02
1.64E+05	7.27E+04	1.062E+04	2.55E+01	6.75E-02	1.90E-02
1.65E+05	7.32E+04	1.070E+04	2.56E+01	6.75E-02	1.90E-02
1.66E+05	7.37E+04	1.078E+04	2.57E+01	6.75E-02	1.90E-02
1.67E+05	7.42E+04	1.086E+04	2.58E+01	6.75E-02	1.90E-02
1.68E+05	7.47E+04	1.094E+04	2.59E+01	6.75E-02	1.90E-02
1.69E+05	7.52E+04	1.102E+04	2.60E+01	6.75E-02	1.90E-02
1.70E+05	7.57E+04	1.110E+04	2.61E+01	6.75E-02	1.90E-02
1.71E+05	7.62E+04	1.118E+04	2.62E+01	6.75E-02	1.90E-02
1.72E+05	7.67E+04	1.126E+04	2.63E+01	6.75E-02	1.90E-02
1.73E+05	7.72E+04	1.134E+04	2.64E+01	6.75E-02	1.90E-02
1.74E+05	7.77E+04	1.142E+04	2.65E+01	6.75E-02	1.90E-02
1.75E+05	7.82E+04	1.150E+04	2.66E+01	6.75E-02	1.90E-02
1.76E+05	7.87E+04	1.158E+04</			

Table 16c

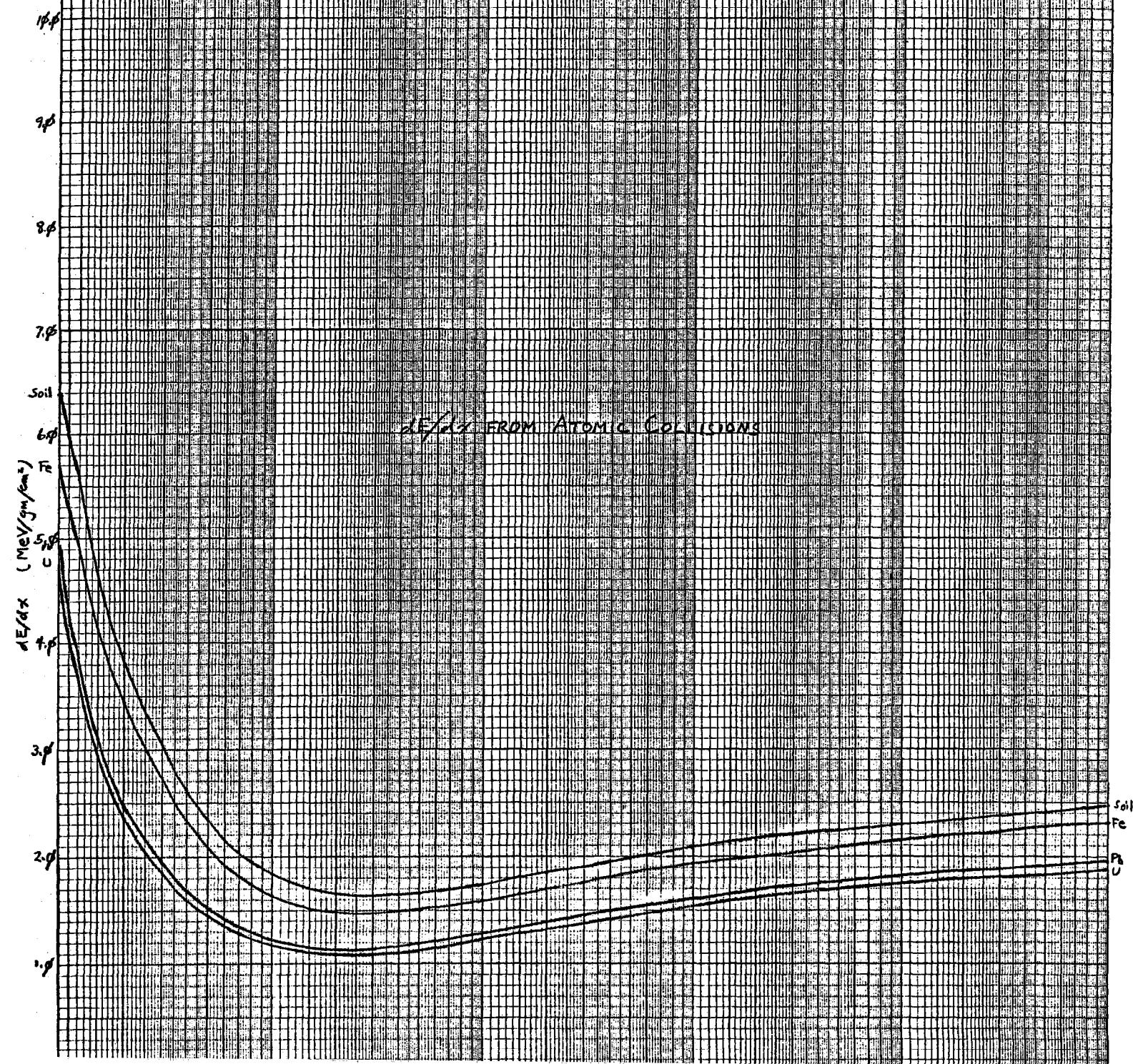
URANIUM Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

Table 16d

URANIUM

Atomic Collisions, Pair Productions, Bremsstrahlungs, and Nuclear Interactions

1 DRAFT



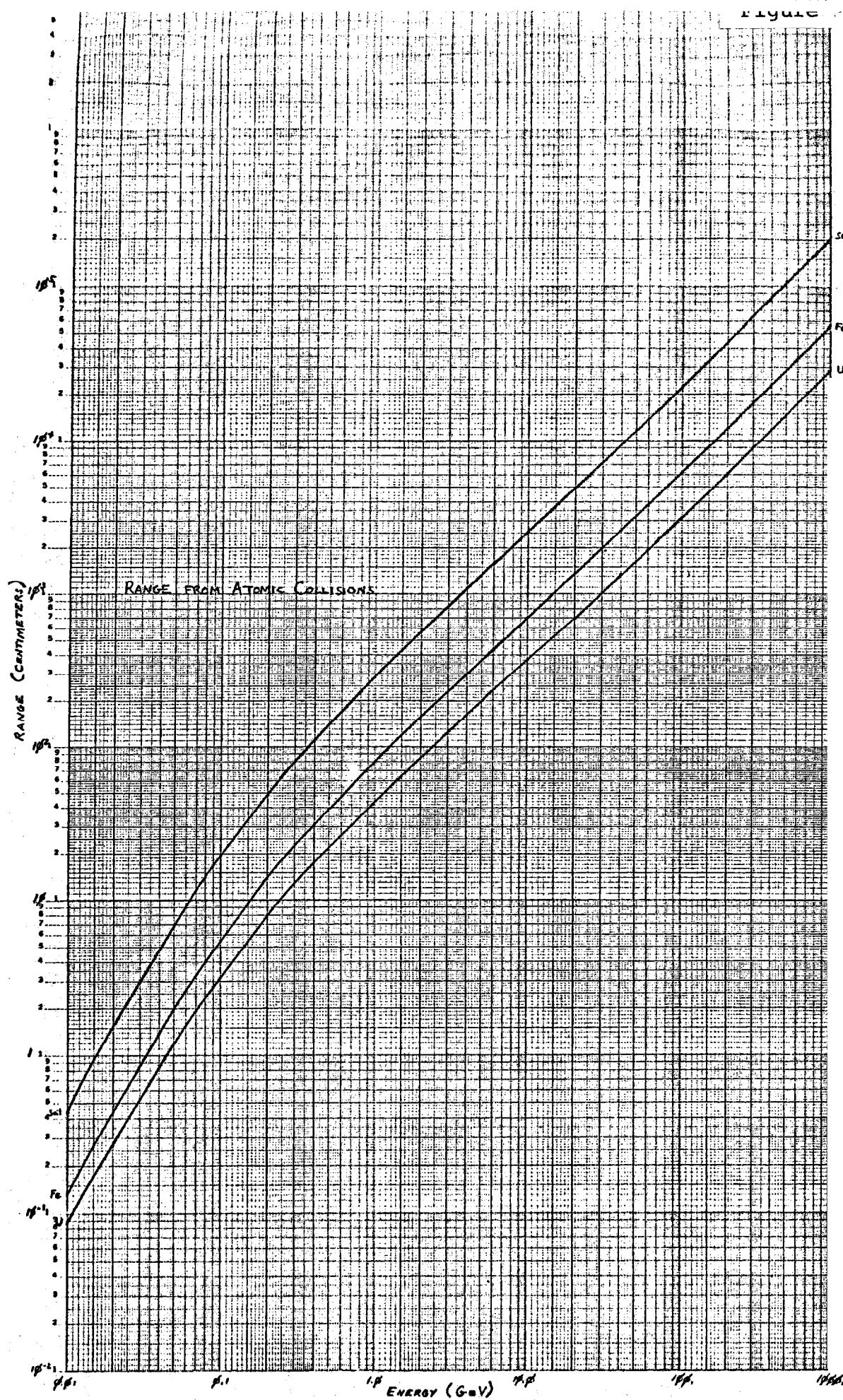
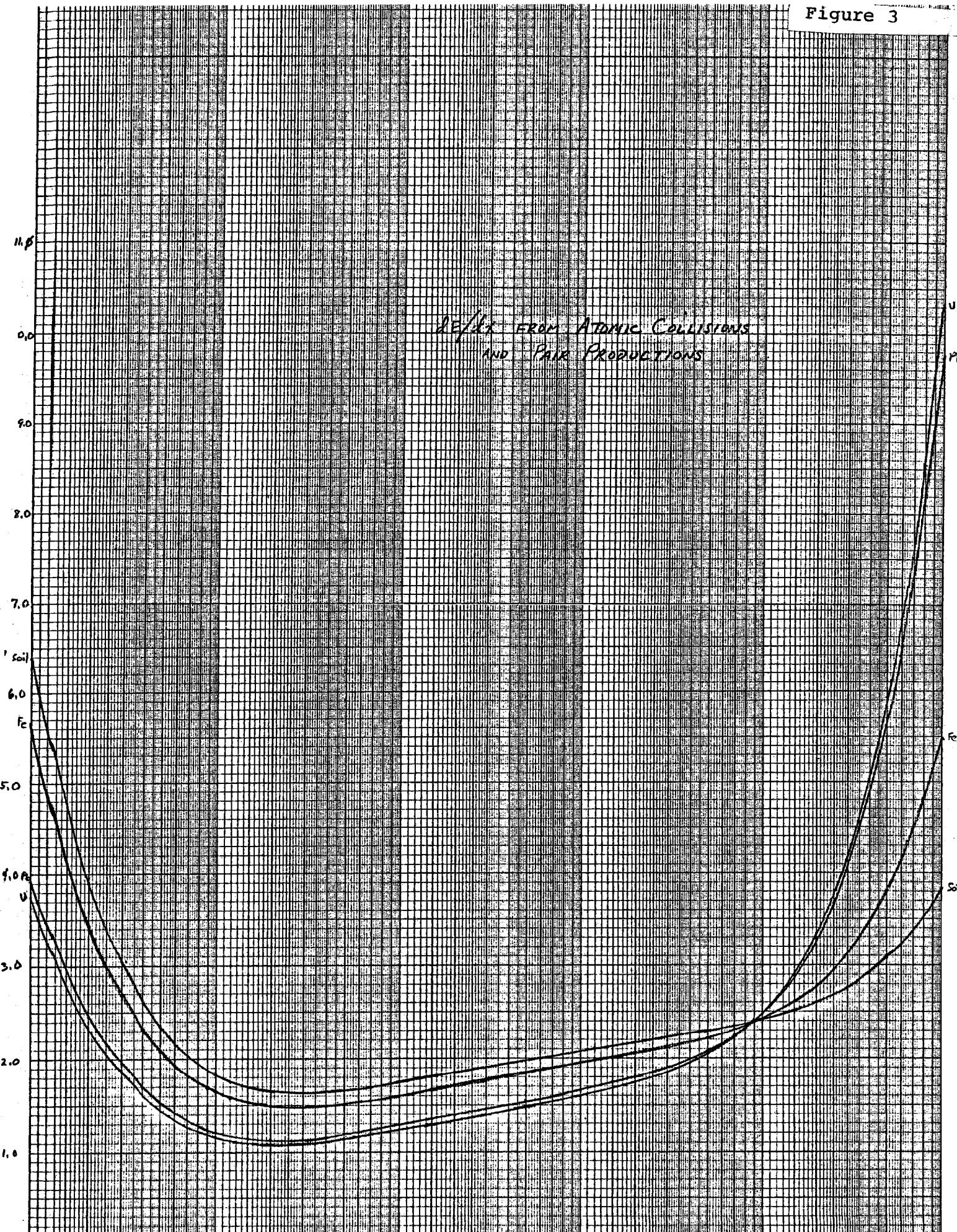
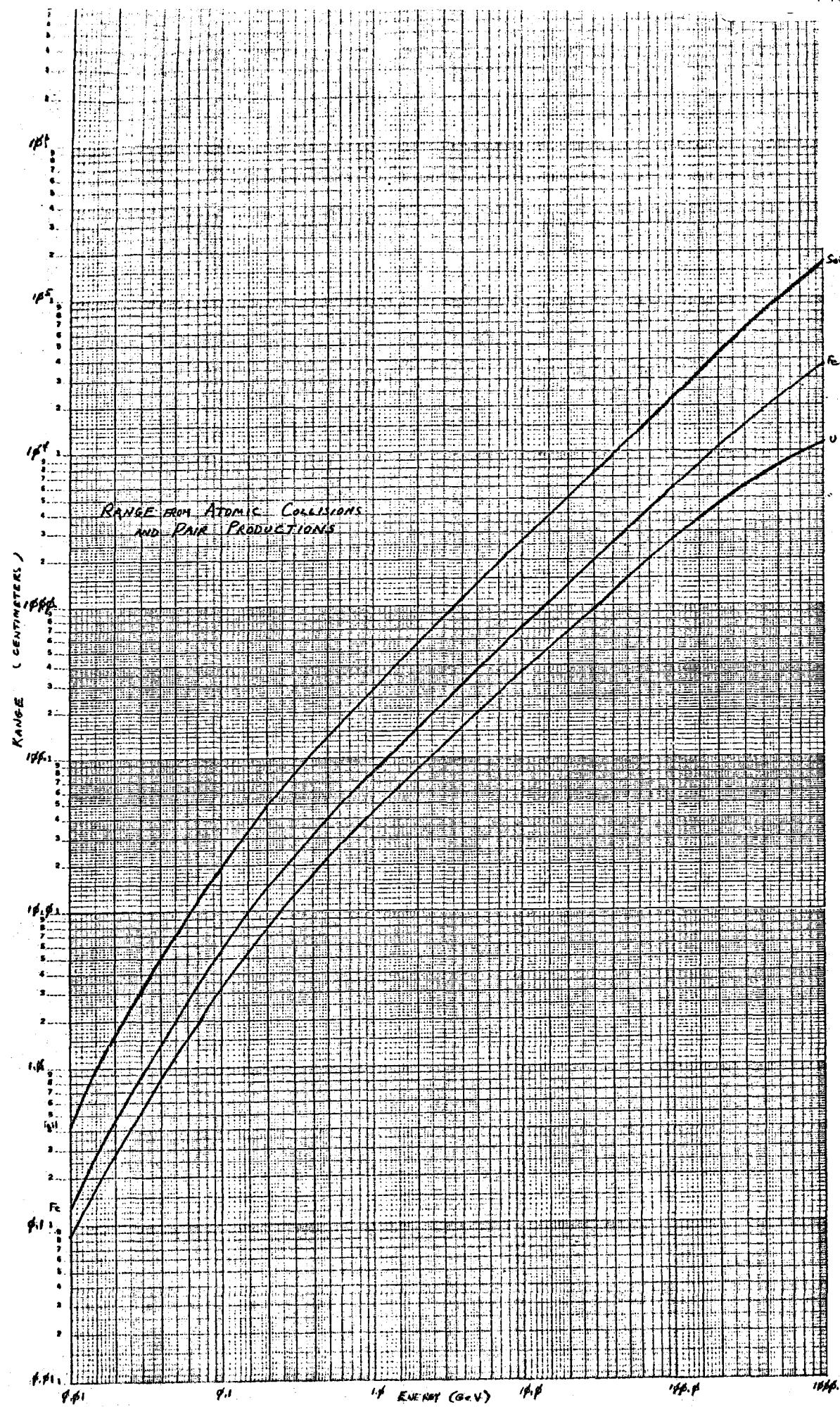
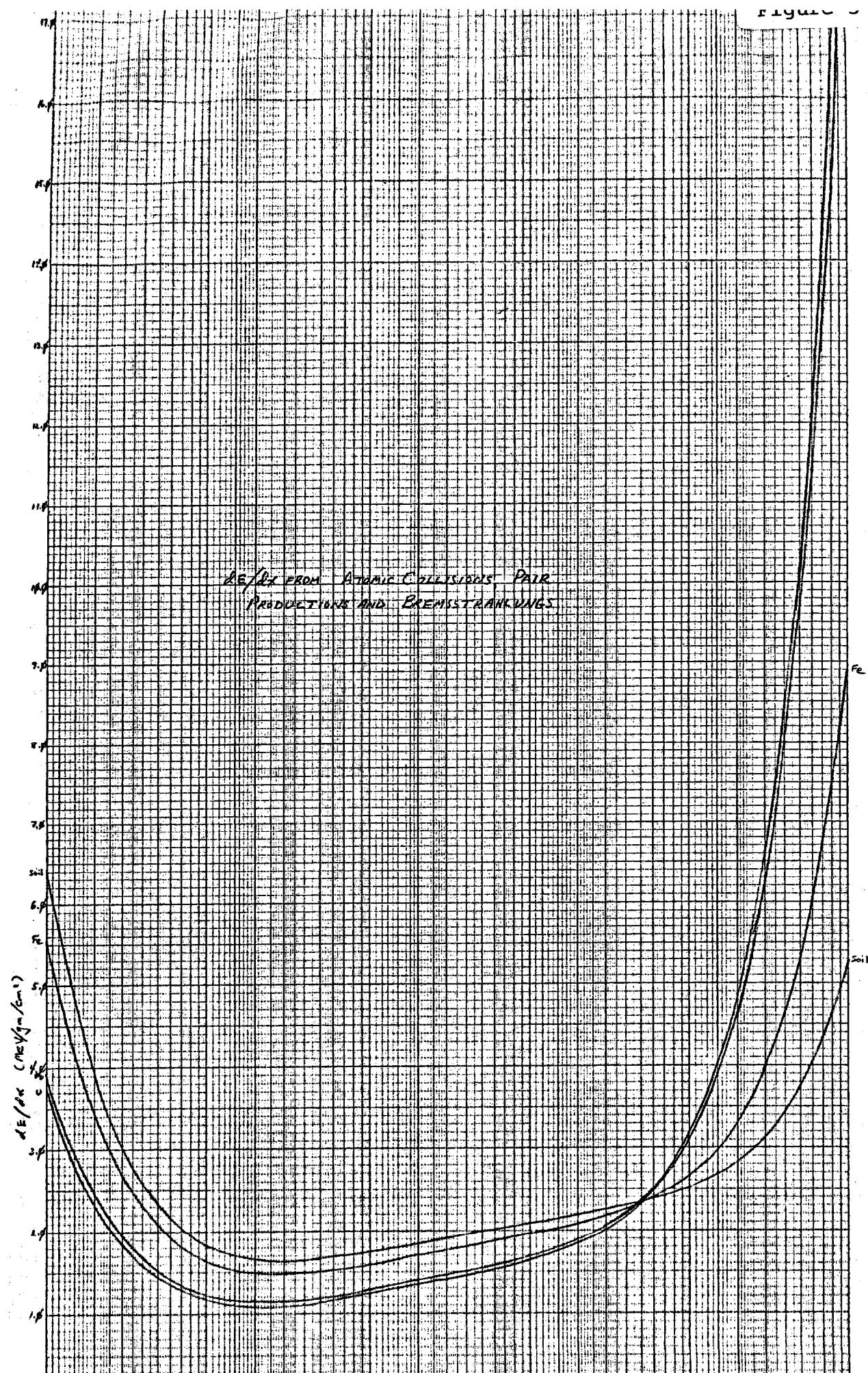


Figure 3

*REFLECTIONS FROM ATOMIC COLLISIONS
AND PAIR PRODUCTION*







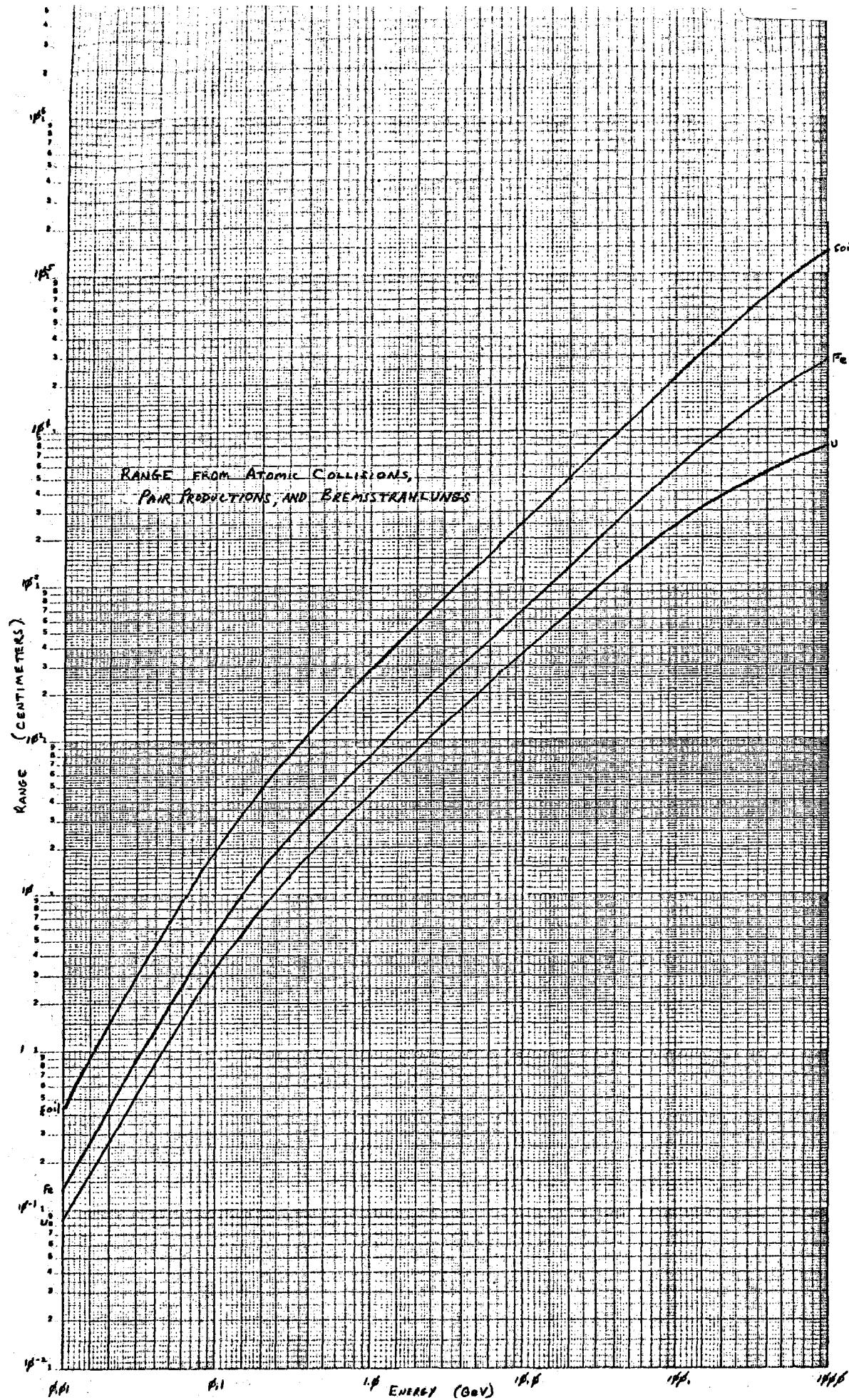


Figure 7

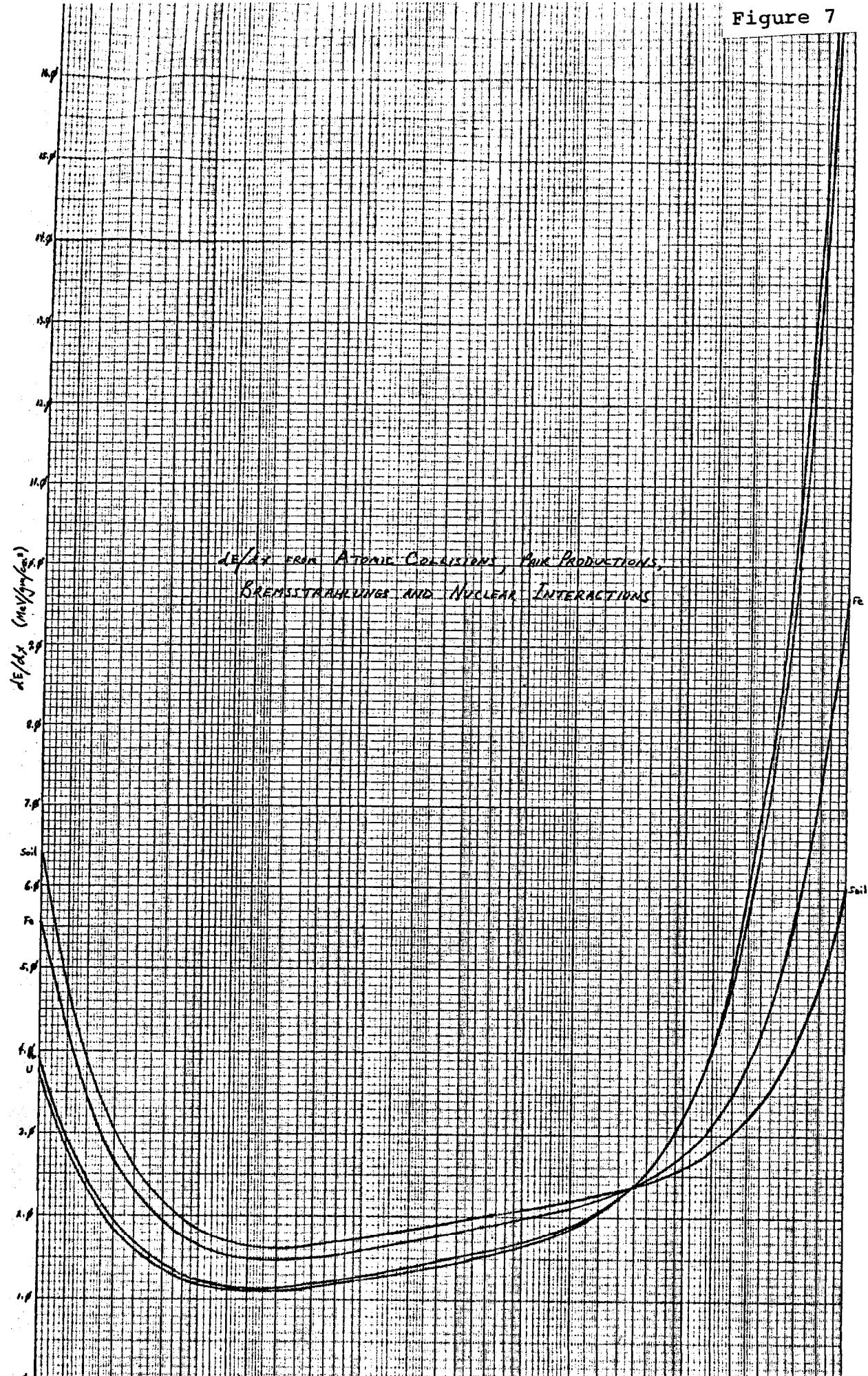


Figure 8

